

AVIATION WEEK

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AVIATION CALENDAR

Sept. 25-26—Mid-Atlantic Distributor Show—Moorestown, N.J.

Oct. 1—Phone Transport Association Agency Committee Meeting—Sherrill Park Hotel, Milwaukee, Wis. C. E. Johnson, Chairman.

Oct. 11-13—International Broadcast News Conference—Argo Hotel, Shorewood Forest Airport, Grand Prairie, Texas.

Oct. 13-14—Caribbean Association—1978 Meeting—Casa de la Costa, New Orleans, La.

Oct. 16—Society of Automobile Engineers National West Coast Meeting—Mark Hopkins Hotel, San Francisco, Calif.

Oct. 19—Phone Transport Association Stand and Practices Committee Meeting—Pilgrim Hotel, Atlantic City, N.J.

Oct. 19-20—Institute of the Armed Forces, National Warfare-Prepared Art Transportation Meeting—Grand Hotel, San Diego, Calif.

Oct. 21-24—Western Telephone Show and Convention—Sheraton Pacific Auditorium and Ambassador Hotel, Los Angeles.

Oct. 21-24—South Atlantic Corp.'s 1978 International Equipment Conference, Atlanta, Ga., New York.

Oct. 24-26—Automotive—Competing Industries University of California World Congress, Los Angeles.

Oct. 24-26—International Northeast Aviation Council—20th annual convention, Bone Island, Fla.

Oct. 13-14—Automotive Society of Merchant Mechanics—Regulations & Regulation Day Meeting—Detroit, Mich.

Oct. 16-18—Automotive Society for Testing Materials—Second Pacific National Meeting and Apparatus Exhibit—Hotel Statler, Los Angeles, Calif.

Oct. 17-19—International Transport Association—12th annual general meeting, Edinburgh, Scotland.

Sept. 17-18—Eleventh Annual Instrument Automation Conference & Exhibit sponsored by the Instrument Society of America—New York, N.Y.

Sept. 17-22—International Congress of Automation, sponsored by the International Federation of Automatic Control, Rome, Italy.

Sept. 21—Automotive Society of Northern California—Annual Production Conference, Bakersfield, Calif., Indio, Calif.

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Vol. 42, No. 2

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New Department to Help Solve Complex Defense System Problems



GEORGE F. METCALF, Vice President and Manager of General Electric's new Special Defense Projects Department, located in Philadelphia, Pa. Mr. Metcalf has had extensive management experience in the military electronics field, both in Government Service and in the General Electric Company's Research Division.

Reflecting the increased complexity of some of the nation's current defense system problems, General Electric has formed the Special Defense Projects Department. The new department will act as a Company focal point for large, highly complex missile projects. Headquarters for the new department will be located near Philadelphia, Pa. This new department has responsibility for large defense systems that require the combined research, development, and manufacturing resources of many of General Electric's operating departments and laboratories.

Managed by a highly skilled engineering and development staff, the Special Defense Projects Department relies upon

General Electric operating departments and laboratories for many specialized phases of its defense projects.

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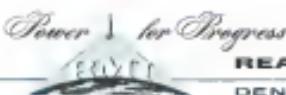
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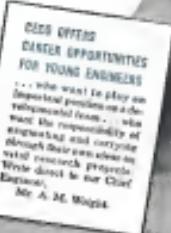
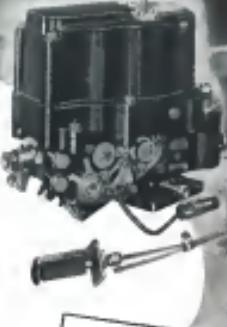
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JULY 8, 1961

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EDITORIAL

Looking Through the Iron Curtain

whether
you
think
in terms
of

Horsepower

or

Thrust

The history of Wyman-Gordon's contributions to aircraft progress dates from the inception of the "flying machine".

The age is now calling on the unparalleled resources of Wyman-Gordon, which include the widest range of know-how and technical know-how in the industry.

Larger and more intricate forgings than heretofore available of aluminum and magnesium are being produced on presses up to 50,000 ton capacity, and giant burners are fueling the growing need for forgings of titanium, high density steels, or sealed super alloys.

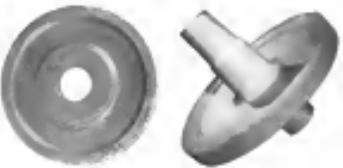
Now, as for aviation in years, there is no substitute for Wyman-Gordon experience and ability to—Keep Ahead of Progress.



The crankshaft is the backbone of the piston-type engine. Illustrated above is the crankcase forging for the most powerful piston-type aircraft engine ever produced.



At the bottom left is a turbine disc forging made from high density heat resistant alloy, and next to it is a titanium compressor wheel forging for two of the most powerful jet engines yet produced.



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The experience of an American correspondent in the Moscow area during the week of the Tushino air show and the visit of Gen. Nathan F. Twining, USAF chief of staff and his technical experts, provided one of the first good news through the Iron Curtain that has shocked Russian airpower development since 1945. For at least this period, the Russians made strenuous efforts to convince visiting correspondents that the Iron Curtain has actually dissolved. Even permanent Moscow correspondents for U.S. newspapers indicated that never post-war history had the Iron Curtain been lowered so far.

During this period in Russia, I met and talked with Russian aviation leaders such as Marshal Pavel Zhigarev, chief of the Soviet air force; Andrey Tupolev, designer of Soviet aircraft designs, and members of his staff; Maj. Gen. Belovka, chief of operations for Aeroflot, the Soviet airlines; Col. Victor Dzherzhin, chief of Aeroflot's foreign division; Mr. V. P. Stepakov, vice president of the Central Glazkov Flying Club of Tushino, sponsor of the air show, pilot and navigator of both Aeroflot and the Soviet air force.

I saw the crews of the Soviet air force demonstrate both their operational equipment and their newest experimental types over Tushino. I saw Badger bombers, MiG-15 and MiG-17 fighters, Iluyshin 28 bombers and Tupolev jet transports on the ground and visited model academies where the Russian youth education in aviation really begins. In addition, there were dark briefings in Gen. Twining.

More important than any of the details seen or heard was the general impression that the Soviet leaders have grasped the full implications of the atomic explosion age and are engaged in a fast, top priority program to provide the USSR with world leadership in that new technology. It is this feeling that the Soviets are operating at full power and top priority in this field as compared with the low Moscow effort and relatively low priority currently characteristic of the airpower policy of the Eisenhower Administration that seems significant. Gen. Twining grasped this inherent point when he asked Commissar Party Secretary Nikita Khrushchev to tenth before Congress as the scale of the Soviet effort to compete with us both militarily and economically.

There is little doubt that a massive effort by both the USSR and the United States in airpower development would set that country's number one within its current surge of superiority over the Russians. However, with the USSR making a maximum effort and this country progressing at half steam, our current range of superiority cannot help but move downward and vanish altogether in the near future.

Consider both the range of the Soviet airpower development displayed at Tushino and the speed of its development cycle as evidenced by the quality of the newest experimental types. The Soviet air force displayed an array of operational types ranging from biplanes that clearly have set world payload and altitude records, through turbine transports, supersonic day fighters, light, medium and heavy jet bombers, and

jet to a supersonic all-weather interceptor loaded with airborne radar and nuclear armament and a turboprop bomber with intercontinental range. There are all jet planes in production and in operational service with the Soviet air force. The front demonstrated by the pilots of large formations operating with split-second timing indicated a high level of training in jet and helicopter operation.

Evidence of the Soviet rate of progress in bringing through new developments and keeping pace with the galloping technology of the air age came during the Tushino display of experimental types. Particularly significant was the 1,200 mph Super Farmer, the new supersonic Yakovlev all-weather fighter and the new supersonic light bomber.

The Super Farmer has been along along into flight test stage by the design team headed by Arseny Malyshev less than 18 months after the original 900 mph Farmer design made its first public appearance. Similarly, the design team headed by Yakovlev has produced flight test prototypes of a supersonic all-weather fighter designed to replace the Flighthawk within two years after the supersonic aircraft burst onto the Western world. The new supersonic twin jet bomber indicates the Russian design team has brought forth a replacement for the Iluyshin design team has brought forth a replacement for the MiG-25 new standard equipment in Soviet and unstable air forces.

Appearance of these three new types shows clearly the Soviets recognize the swift rate of obsolescence problems inherent in progress in air armaments of military aircraft, and they are not shrinking from the arduous task and vast expenditure this job requires.

It is too early to evaluate the significance of Paul Salomon delta fighters except that this shows the Soviets have not neglected this design approach and are flying prototypes that are certainly supersonic.

In the transport field, the Soviets have at least four new gas turbine powered transports well along including the turboprop Antonov marsh transport that flew at Tushino, the Iluyshin 18 turboprop transport whose prototype is nearing completion at Antonov's Factory No. 30 in Moscow, the new four jet Tupolev ultralow flying test stage, and an extremely large turboprop transport based on the Bear bomber design. In helicopters, the Yakovlev 24 with its twin engines and 8,000 lb payload is comparable to anything flying in the world.

General Twining and his party also got a good look at Soviet aviation engineering and military training operations and saw more than anybody outside the Comecon Bloc has previously seen of engine and aircraft production.

First hand on-the-spot observation of Soviet airpower in both military experts and technical specialists has revealed nothing to contradict the testimony given Congress in recent months concerning the quantity and quality of Russian aircraft. In fact, these observations confirm in every detail the gravity of the competition we face to preserve air hegemony.

—Robert Hiltz

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WHO'S WHERE

In the Front Office

Howard E. Dillig, Headlock, director of aircraft planning, Northwest Aircraft, Inc., Hawthorne, Calif. Mr. Dillig is a frequent speaker at aircraft conferences. Past editor-in-chief, he is president manager July 31, as existing has as treasurer Charles G. Caley. Harry J. Schwartz, chief, now general support and test equipment department in new 500-ft. 1947 Start requirements.

John J. O'Neil, vice pres., president engineer and designer, Hughes Electronics Corp., Los Angeles, Calif.

Don W. Burns, vice president-purchasing manager, Hughes Aircraft Co., Los Angeles, Calif.

Harry H. West, Jr., assistant to the president, de Havilland Corp., Los Angeles, Calif.

Honors and Elections

Theodore E. Dornbusch, planning director, defense products group, Avco Corp., Worcester, Mass., received the U.S. Defense Department's distinguished civilian service award for outstanding contributions to the nation's defense interests.

Eric Ketchel, technical director, Wright Air Development Center's Bureau of Personnel, received the National Civil Service League's Carter Award for 1952.

Candido L. Melnick, Maritime Control Agency pilot, received Dennis Melville Trophy for "outstanding work in connection with the combat ends warning line."

Roger C. Flory, research relations director, Vought-Sikorsky Control Systems Corp., elected chairman of Aircraft Industries Policy Relations Advisory Committee, for 1953-1954.

A \$200 annual award has been established by the Council of the Institute of the Mariner Sciences to be granted to the individual making the outstanding contribution to navigation during each year. An interview dinner concluding October 10, 1953, will be held.

Changes

Edwards L. Hinkley who coordinates public works programs, Los Angeles, Calif., has left Southern California Edison. Mr. Hinkley

Robert O. Peck, manager Service Division, Schenck Corp., has been appointed managing director, Schenck Corp., New York.

Walter C. Riesler, plant manager, Avco Corp., Princeton, New Jersey, has been promoted to manager of Avco Corp., Newark, N.J.

John L. Miller, defense activities director, Lockheed Test & Barber Co., Akron, Ohio.

C. E. Lovell, afterburner engine, Vickers-Armstrongs, Farnborough, England, Eng land.

Paul Mikonis, Pan American World Airways, Bangkok, Thailand.

J. S. Johnson, manager, Allis-Chalmers Division, Allis-Chalmers Division, Milwaukee, Wis.

(Continued on page 52)

INDUSTRY OBSERVER

(The following column was written by AVIATION WEEK Editor Robert Herbst from Moscow where he witnessed the T-33s as shown and interviewed Russian aviation leaders.)

► **T-33s.** Two T-33s jet transports now being used for service with the Airforce, the Soviet air force, is much larger than the Badger bomber although their platforms are similar. Good opportunity for comparison of these in a usually less affected situation at Moscow's Vnukovo Airport where several T-33s were parked next to a Badger being used to check out Antonov transports on pit operations. Badger wing span is less than that of the T-33s, transport, and the Badger's landing gear is much shorter than the transport, putting the short Badger tailplane closer to the ground. Difference in tail height is even more than would be necessary in a simple transition from Badger to transport on the same scale. Badger still retains B-52-type tail fin/tail surfaces.

► **MIG-15s.** Observed on several occasions had three wing fences on each wing with one extremely close to the fuselage on each side and two spaced closely together about half way down the span of the swept wing. MIG-15 also has an airbrake fitted in its RD45 centrifugal flow turbine giving total thrust of slightly more than 7,000 lb. At altitude of the current MIG-15 is noticeably larger than on the earlier MIG-15.

► Radar installations for both airfield and en route use are very much in evidence around Moscow airfields. Mobile search radar mounted truck and shrub-like trailer in a single set (allowing portability). Large antenna for mobile earth. Portable vans used for the mobile, portable basic radio, receiver, communication equipment, tests and power supply. Cockpit tracked vehicles are provided with their seats for transport.

► Soviet air force and Antonov use 100/50 octane gasoline. According to western sources support for octane rating has reflected unusually large percentage of lead additive which causes excessive spark plug fouling on Western-type equipment. Plugs with sulfur points are necessary when using Russian gasoline.

► Russian admirers to Anton Mikulin as the designer of the Yarrow 900 mph fighter and the 1,700 mph Super Yarrow) believe that the design team of Mikulin and Gagarin made famous by the MIG-15 during the Korean war has now been dissolved. No references to Soviet work by Mikulin appear in Russian newspapers or aviation magazines.

► Some operational fighter groups of the Soviet air force have adopted a very poor scheme using a broad rib shape down the leading edge of the vertical fin and extending forward along the top of the fuselage to the nose. This older scheme was used on the Fw-190 (MIG-17) and Fries (MiG-19) types during transition activities at the Tushino base and appears in other illustrations in Soviet magazines describing Fries work.

► Convair aircraft 3300 to 3,500 ft long are in evidence on airfields throughout western Russia. Other models a size but in an orthogonal pattern of controls, form but looks more or less like large square sides. Pattern of Russian model makes visible evidence a diagonal forward area with concealed front aerial observation. Soviet air force also has equipped MiG-15 and MiG-17 with a pair of lighter quadrilateral airbrakes/gurneys positioned on wings just behind the leading edge. These are positioned at an angle of attack much greater than that possible with similar USAF types such as the F-86 and straight wing F-84 types.

► Radar ground controlled approach (GCA) is the primary Soviet air force and Airfield bad weather landing aid. GCA equipment of Russian design and looking radically different from U.S. type is in evidence on all airports observed between Riga and Moscow. Soviets also have developed an ILS-type local landing system operating on a different frequency than Western types. Russian ILS also has four fan markers compared with three on Western systems. Gadget computer indicators for Russian ILS are about the same as Western types.



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WASHINGTON ROUNDUP

A Shock for NATO

Defense and State Department efforts to bolster waning European enthusiasm for the North Atlantic Treaty Organization were jarred by the release of testimony by Lt. Gen. James M. Gavin, Army secretary and development chief, given before the Senate Airpower Investigating Subcommittee.

Lauded from an all-out U.S. nuclear attack against the Soviet Union would result in the deaths of hundreds of millions of people. Millions of these probably would be allies—“If the wind blows northeast... they [the death] would extend well back up into the Philippines area. If the wind blows the other way, they would extend well back up into Western Europe.”

Vice Adm. Arthur C. Davis, who has commanded the submarine fleet's closed-loop test mission prior to its release for publication, allowed the testimony to pass, a spokesman said, because he felt the wide spread disclosure of unscripted fallout was not known. But even submarine test member Sen. Henry M. Jackson (D-Wash.) was surprised. “I am shocked,” he said, “at what the Department of Defense has released, not from the standpoint of security but from the standpoint of our friends throughout the world.”

Sledge Hammer and Sky Cov II

Pending final settlement of its feud with the Air Force over an unusual equipment request, the U.S. Army has moved quickly to activate a new name called Skir Cov II and has scheduled it for an important role in Exercise Sledge Hammer to be staged at Ft. Polk, La., next February and March. Ft. Polk was the scene, last fall of Exercise Superdrill when activation of Skir Cov I was tested in the service's scenario in the Pentagon. Skir Cov I included heliships and light planes. Its mission was primarily reconnaissance.

The Army is close-monitored about Skir Cov II, saying only that it is a light classified to destroy. At the same time, it has joined with the Navy in flying wings from three-year-old Korean disease helicopters.

Army says its use of choppers could facilitate operation of remote television cameras built behind front-line camouflage nets and other missions related to Skir Cov operations during Sledge Hammer.

Plan for Sledge Hammer's Sledge Hammer call for troops of remote control equipment and aerial supply of arms. There is no indication that the Army expects to exploit the USAF's C-123 assault transport, despite the fact that planes and crews are being housed at Andrews, Md., to provide support for Army exercises.

More Defense Secretaries?

The House last week overwhelmingly approved legislation authorizing a new assistant defense secretary for research and development for each of the three services, but its chance of enactment is probably zero. (Since the Air Force already has assigned one of its congressional seats and attention to research and development, the effect of the legislation on the USAF could be to give legal status to the assistant secretary for research and development and permit a new assistant secretary for installation.)

The Senate has told the President's request

for the legislation, recommended to him for submission to Congress by Secretary of Defense Charles Wilson, and it has not once been introduced as the floor

Satellite Research

An Air Force general working on urgent research and development projects doesn't get off on his first few tests from test range and a资助ed budget. For example, Lt. Gen. Donald L. Pritt, USAF's Deputy Chief of Staff for Development, recently received in the mail a silk and paper dossier set. Covering letter from a Florida rocket manufacturer requested information on the shape, color and markings of the U.S. satellite to be launched next year. Gen. Pritt was asked to provide data for production of a silk and paper set with the satellite model.

New Challenge to Wilson

The Senate Airpower Investigating Subcommittee is expected to roll new accusations with Gen. Nathan F. Twining, USAF Chief of Staff, and Allen Dulles director of Central Intelligence Agency in view of the testimony of Defense Secretary Charles Wilson (see page 29). The subcommittee's chairman, Sen. Stuart Symington (D-Mo.), charged serious differences of opinion had plagued Wilson's testimony seeking the Administration's defense program with previous testimony given by Twining and Dulles.

The subcommittee is expected to write two reports as the upper chamber's committee is split into three Democratic members objecting to the Administration's program, the others five Republicans supporting it.

Quarles Intellectually Honest

Scrutiny of the Air Force Donald Quarles won the compliments of the three Democratic senators on his testimony before the Senate Air Power Investigating Subcommittee (AW, July 2, p. 11). Sen. Strom Thurmond (D-S.C.) cited differences of opinion but praised Quarles for being "methodically honest."

Under questioning Quarles said that the learning of public attention was anxious by Congress and that Quarles had had a very wise influence. "Gatherer" signed as assistant secretary of the Air Force for research and development in February to protest over the budget battles on the R&D program.

CAA To Study Comet, Coravelle

A team of Civil Aeronautics Administration engineers will be sent abroad within the next few months to evaluate the de Havilland Comet 4 broad beamline and using 25 other foreign aircraft in U.S. certification. A preliminary type board meeting will be established in England for the purpose of making the studies. Final application for the Comet certification was received last month in the CAA from de Havilland Aircraft Company through Air Registration Board council.

Included in the evaluation will be the Coravelle jet transport and the Fokker Friendship. Recent modification of the Vickers Viscount also will be brought under study by the CAA group.

—Washington staff



TUPOLEV TU-104 twin-jet transport No. 27 is on tarmac in front of Moscow terminal prior to proving flights to Omsk and Khabarovsk.

Aeroflot Plans International Jet Routes

Soviet airline pushes turbine transport plans, seeks routes to Western Europe, North America.

By Robert Notz

Moscow-Aeroflot government-owned airline of the Soviet Union, is pushing a major expansion based upon its turbine-powered equipment and new traffic routes to Asia, Western Europe and North America.

Headed by Mr. Gennadiy Beloborodov, Aeroflot operations chief, and Col. Vsevolod Donschenko, chief of Aeroflot's foreign division, in an interview with AVIATION WEEK in the airline's Moscow headquarters,

Aeroflot, which is headed by An-

tonov S. I. Zaytsev, one of the world's largest airlines operating routes equivalent to Pan American World Airways' 61,600 unplanned route miles with a fleet of 900 Douglas twin-engine transports, at least another 100 Douglas DC-3-type L-4s and 10-passenger Antonov An-2s plus several smaller aircraft will be added to the fleet. In addition to its extensive airline operations, Aeroflot also builds and operates civil airports, communications and leading info. trans. points, tv news and communications personnel, conducts all spaceflight training and port control.

• **Tu-104 twinjet** 40 passenger turboprop transport has been engaged at busy air bases and in sister Aeroflot service on the Moscow-Dresdner express route to Khabarovsk on Siberia. The Tu-104, of which two are now flying, is still in the final stages of proving operations on the Orient route. Events tally, Tu-104 operations will be extended to Prague in Western Europe and Peking in China. Mr. Gennadiy Beloborodov indicated that Aeroflot's expansion "presently differs" with the Tu-104 but added that they were the normal type of "big" aircraft in getting out new type of aircraft fully operational.

• **Antonov twin-turboprop** transport will be adapted for Aeroflot operations as a cargo plane. General Beloborodov stressed had a heavy demand for all cargo services within the Soviet Union but was handicapped by the small doors and limited capacity of the Tu-2 and Il-12 equipment now available for such service.

• **Tupolev four-jet long-range transport** for international routes to Asia and North America. This plane believed



ROBERT NOTZ, editor of Aviation Week, in front of terminal building at Vladivostok.



IL-14M TRANSPORT at Vladivostok airport shows on Aeroflot's flag under Soviet government overflew air strip.

to be based on the Ilyushin heavier design but considerably scaled up in size is likely to be designer Andrey Tupolev's IL-16 passenger transport. Prototype virtually completed and is expected to fly soon.

• **Ilyushin IL-14 turboprop transport** with a 70 passenger capacity used as an short-stage length route. Prototype of the IL-14 is sailing companion of An-20craft An-20 aircraft No. 10 near Moscow Central Airport and is expected to fly the summer. It is a low-mounted nosewheel design powered by four turboprop engines.

• **Lavochkin turboprop transport** based on the R-1000 engine. This is aimed at long range, high density routes. Little is known about the progress of this project.

Aeroflot has gained its initial operational experience with the IL-12B light bomber. The IL-12B has been operating on a high priority cargo and newspaper routes from Moscow to Siberia for about 17 months. Aeroflot also has a Badger medium bomber based at Vladivostok for maritime training of crews in jet operations.

With these plane records, announced at the 2nd Congress of the Commissariat Party cells for Aeroflot to increase its cargo capacity by 100% and its passenger traffic by 300%. Much of the passenger traffic is expected to come from expansion of international routes. Aeroflot now has bilateral agreements with 22 foreign countries, use of their Government websites.

Most recent agreement was signed with the East German government in late June.

Next on the Aeroflot agenda is Pan American World Airways. The airline is expected to send a technical mission to Moscow in mid-July. It will be followed by Pan American President Jim Tropic who will negotiate a trai- de agreement.

Aeroflot and Scandinavian Airlines System are making considerable road and air routes over the SAS route route to East Asia.

In addition to the western European satellite countries, Aeroflot now operates international services to Peking, Cheng Kabel, Afghanistan, and the Scandinavian terminals of Helsinki, Stockholm and Copenhagen. Wester Aeroflot traffic has increased 10% annually for the past three years with the exception of 1962 because since trade between have been severed between western Europe and China. Aeroflot now operates up to four planes eighth or +12 hour service from Moscow to



INTERIOR OF CIVIL AIR TERMINAL at Vladivostok, 20 miles south of the Soviet capital, has wooden benches, large statue of Stalin and a well-kept map of Aeroflot routes.



Il-14 AIRLINES are on trial assembly line at Aircraft Plant No. 30 at Moscow Luch Airport. The factory's oldest aircraft plant in Russia, was inspected by Gen. Nathan F. Twining, USAF chief of staff, during his visit to Russia (AW July 2, p 29). Eighteen mid-24 passenger models of the Il-14 are being manufactured.

Peking, including an eight-hour delay for passengers on the ground at the border airport of Irkutsk. Original winter route to Kabul was recently dropped.

Last letter on the eight weekly flights from Moscow to Southeast Asia has been averaging 8200 miles for the routes opened last spring, with stats hard to get during the summer tourist season. Overlays suffice on the route to spelling out the Aeroflot and Czech airline routes to Prague where connecting

Report From Russia

This is the first of two articles by Army Week Editor Robert Della on the operations and future plans of Aeroflot, the government-owned airline of the Soviet Union and one of the key factors in the recent Soviet policy of lessening the Iron Curtain by pressuring the Iron Curtain to permit an increased flow of international traffic to the West. These stories are based on interviews with Aeroflot officials in Moscow, travel on its services and observation of its operations at airports in western Russia

transports into service. Col. Donatovitch also told AVIATION WEEK that Aeroflot is making a detailed study of both Intra-Soviet Civil Aviation Organization and International Air Transport Association regulations and would decide whether to pass these regulations after that study is completed.

Navy Announces Order For Temco Jet Trainer

Temco Aircraft Corp. of Dallas has received a Navy Bureau of Aeronautics contract to build an "evaluation prototype" of the Temco Model ST primary jet trainer.

The contract, designed to provide the Navy with the first primary jet trainer, also represents the first production order Temco has received for a complete aircraft of its own design. First delivery is scheduled for July 1961.

The Model ST, built and flight tested by Temco at its own expense, was accepted by the Navy after one positive evaluation test at the Naval Air Test Center, Patuxent River, Md.

Powered by a Continental J35P-79 engine rated at 930 lb thrust, the aircraft has several characteristics of standard jet fighters, including ejection seats, liquid oxygen equipment and speed brakes. With a maximum speed of about 680 mph it can land at 35 mph.

Temco engineers say the Model ST can fly over a 50-ft altitude in 1,000 ft. Endurance at sea level is 100 min and nonstop, the average cooling is 30,000 ft.

Cable Error

Due to an error in cable transmission from Moscow, the new superstage Tu-144 all-weather fighter was labeled a Super Flamingo in last week's special report on the Soviet airforce in *Aviation Week* (AW July 7, p 16). The Super Flamingo is a MiG-21 supersonic fighter. It was reported wrong over the original French supersonic fighter and has a top speed of 1,420 mph, sites say.

The new Yakovlev supersonic all-weather fighter flew in two versions at Tushino. One had a needle nose gun pod indicating all-weather function. The other had a photo/bomber-like nose containing a short air intake for a light bomber or strike plane. The new Yakovlev supersonic fighter is about the same size as the earlier supersonic Yak-28, which has a higher degree of wing sweepback, more powerful jet engines and an extremely clean, round fuselage design (see p. 30).

Aeroflot now operates six class services but will go to tourist and first-class distinctions when it puts the big jet

Wilson Faces Symington, Defends Policy

By Katherine Johnson

Washington—Secretary of Defense Charles E. Wilson, testifying in the face of challenging testimony from Capt. Fred Heales, defended the Administration's popular "no reservations" without reservations" during hearings last week before the Senate Armed Services Investigating Subcommittee.

At the conclusion of the hearings, Subcommittee chairman Sen. Stuart Symington (D-Mo.) declared that Wilson's "overzealous" was "unwise" with that given earlier by Gen. Nathan F. Twining, USAF chief of staff, Allen Dulles, head of Central Intelligence Agency and other leaders. From this, Symington surmised, it could only be deduced that the military leaders "shaded" or "distorted" their testimony for their own convenience, or that Wilson had "shaded" or "distorted" his testimony for "partisan purposes" to support the Administration's final plan of looking down the road.

"There is fact, interpretation and opinion," Wilson replied. "We don't all agree on the interpretation, and opinion." He said he had encouraged military leaders to testify before the subcommittee "to the best of their knowledge and ability what they have learned" and "did not attempt to guide anyone."

Symington countered that there are "undeniable differences of fact" between the sworn testimony of Wilson and the military leaders.

Wilson Challenges LeMay

Non-classified testimony, which Wilson called "ridiculous,"

•**Statement of Gen. Curtis LeMay.** Commander of the Strategic Air Command, he asserted that, under the present U.S. program strategic bombing capability will just be Russia within four years. White and Gen. LeMay had no one-dimensional answer to the \$5.5 billion difference from Capt. Heales in a planned 20,000 B-47 striking force as actions which can be taken in conjunction with the Fiscal 1958 budget which could affect the posture within a few years.

•**Gen. McLeary's statement** that Russia's long-range jet bomber, the Bear, is "irreversible" in the B-52. Wilson said the B-52 is "greatly superior in speed, combat range, and combat end."

•**Testimony of Lt. Gen. Donald Putt**, director of staff for research and development that budget cutbacks are reducing key defense projects. Wilson said no important research and develop-

opment projects have been delayed over the past three years because of money cuts. He said a poor search for sources "under budget" at close of fiscal 1957 was responsible for the cutbacks. Development work was suspended in 1953, he said, because research pointed to none clear-cut approaches. If that had not been done, he added, an atomic-powered plane which would be but be of no military use" would have resulted.

•**Statement of Gen. Twining** that, in numbers of planes produced and rate of progress, the U.S. is "falling behind" Russia. Wilson emphasized that Russia started its aircraft buildup from a far inferior position to that of the U.S. Although "they are catching up," he said, "I don't think we are falling behind." The U.S. is still clearly superior. Our rate of progress in our power is very rapid."

House Forces Budget

Two developments on the aerospace budget in Congress last week were:

•**The House** reluctantly went along with a \$300 million increase in USAF funds for aircraft procurement already voted by the Senate in giving fiscal 1958 to Fiscal 1957. At the insistence of the House, a provision was accepted making it clear that the additional funds might be used to expedite the production of heavy bombers, tankers and other critical Air Force weapons.

Symington countered that there are "undeniable differences of fact" between the sworn testimony of Wilson and the military leaders.

Wilson Challenges LeMay

Non-classified testimony, which Wilson called "ridiculous,"

At House committee a provision also was adopted that the \$500 million increase—over and above the Administration's request—could not be interpreted as an automatic toward a general and loose fiscal procedure.

The additional \$100 million voted by the Senate for USAF research and development was approved by the House.

•**Secretary Wilson** pointed to "facts" that USAF's fiscal 1958 budget would increase from \$4 to \$2 billion over the \$16.4 billion appropriation for Fiscal 1957. Proposals that will be considered in connection with this budget, Wilson disclosed, include an increase in planned B-52 bomber wings from 11 to 17 and a boost in aircraft in overall B-52 production, an increase in USAF tanker production and in aid for the Air Force.

The proposal for the increase in B-52 wings has been formally presented by Gen. Twining. Wilson reported that both he and Gen. Twining consider the greatest planned production of 10 to 12 wings to be the desirable optimum. He told the subcommittee, however, that as yet the Congressional committee on funds for the Strategic Air Force would review the situation and consult with Gen. Twining upon the latter's return home. Macmillan, whom he visited the Senate's June 24 air show (AW July 7, p 26).

The Democratic manager of the defense budget in the House side-Barney George Mahan (D-Tex.), chairman of the Appropriations Subcommittee on the Armed Services—was critical of the action of Democratic senators in boosting Air Force funds.

Apparently referring to the Syring



Wilson on Defense

Secretary of Defense Wilson reading testimony before Senate Armed Services Subcommittee with Adm. Arthur Radford, chairman of the joint chiefs of staff, by his side. When he defended the Eisenhower Administration's popular policy "without reservations."



NEW SUPERSONIC TAKDVEY, all-swept fighter flew in the Tushino air show. Note pointed canard nose. Swept wing has one angle of sweep back from leading to engine nozzle and another from nozzle to wing tip. Wings are squared off with no sweep past takeoff tips. Dark spot under fuselage probably is a rocket firing port. Large radars are for 10 000 ft. distant visual jet warfare. Photo from Soviet Foreign Ministry photo.

Russia Shows Off New Aircraft

SUPER FARMER, denoted by Mikors, is Tu-134A-3 (left) shown here. Features are: undercarriage standard; fabric never varnished tail and dorsal finning. It is at 23000 ft. max. Note the high degree of wing sweep back on operational Tu-134s in Antonov's formation (below). Relatively high aspect ratio wing is for extremely efficient performance. Long flat fins of fuselage content with broad slope of VIG-15 and VIG-27.



ANTONOV ASSAULT TRANSPORT, powered by two turboprop engines, has four rear fins. Up swept aft section of fuselage permits rear landing gear to touch level. Bulges along bottom of fuselage house landing gear. Navigation antenna bulge under the nose. Design, with large vertical fin, is strikingly similar to Lockheed's C-130, save being built by PZL-Mielec. Side view of Antonov transport (right) shows long fuselage which appears a "tad longer" than the C-130 but is not quite as long as the Lockheed C-130. Slim wings have 4000-6000-lb/turboprop engines.



THREE VERSIONS OF PAVEL SOKOLOV'S experimental delta fighters flew in the Moscow air show. One delta prototype (left) has pointed anterior nose with large air intake beneath. Like the Convair X-100, canard fairings project from nose radome to that on the North American F-100. Note the long wing span provided by extremely thin delta wing; low aspect ratio and large vertical fin. Large diameter of tailplane indicates Sokolov delta is equipped with afterburner; afterburners were not used during the Tushino flyby. Side view (top right) shows large vertical fin and low position of horizontal stabilizers. Another version (bottom right) has large air intake, but no fairings over canard fairings. Conventional empennage is squared off to decrease drag, shortening fuselage. A third version (not shown) has no fairings; extension of trailing edge delta. It has a large vertical fin with horizontal tail mounted half way up. All three exhibited fast rates of climb without afterburners.





FORMATION OF FLASHLIGHTS Index by Soviet photographer shows this formation and test firing to improve aerodynamic flow. Missing of horizontal stabilizers at mid-point of sharp, upward-tilted tail is typical of earlier Soviet missile design. Long, thin point 5,000 ft. threat and range.

BEAR TURBOFOP leader is escorted by MiG-17 fighter fighters. Test comment and restraining propellers are clearly visible. These fighters appear to have horizontal tail mounted on top of control fin. Both fighters, also, have clear fins.

ten microseconds. Mahon declared as a four quote below) the final appeal of the budget manager:

"Along a similar line how much defense do we need to have a big taking less deep in the ocean, how high in the sky?"

These words may be an assumption that alert men think about national defense, but they should not consider themselves as budgetary, neither. I wouldn't disagree with that opinion. National defense, to be effective, must take into consideration the economic structure, the taxpayer and the survival of our way of life while it's not to mention peace."

An official USAF statement as to a four quote below) the final appeal of the budget manager:

"It's a terrible idea to have a big taking less deep in the ocean, how high in the sky?"

Mahon replied that his statement had been meant that Russia was building "over" defense posture. In 1954, he said, the Defense Department last month that Russia had one from but that "in play at site" had opened a second source of B-52 production at the Boeing Airplane Co plant at Wichita and increased target output from since to 15 a month.

Mahon also pointed out that the USAF recommends an additional \$200 million for research and development but that the Senate voted only an additional \$100 million.

White House Strengths and Hopes Jackson (D-Wash.) were suggesting that Secretary Wilson move to step up B-52 production, Mahon retorted the House was in a "cost-cutting" program. Mahon said that there is nothing in the Defense Department's plan "to jeopardize a graduated basis, phasing in the cut things and phasing out the old. Of course, the present trend must not be stopped."

What Budget Provides

The \$34.6 billion fiscal 1957 defense budget signed by the President last week provides the services

- Air Force, \$16.4 billion (This sum plus \$14.7 billion for fiscal 1957. The first "block" estimate of Gen. Truett is that \$2.7 billion will be the fiscal 1958 requirement)
- Navy, \$12.8 billion as compared with \$9.1 billion for fiscal 1957. Total cost estimate for fiscal 1958 is \$13 billion
- Army, \$14.7 billion as compared with \$12.7 billion for fiscal 1957. Army's total estimate for fiscal 1958 is \$12 billion

The first estimates of the services for fiscal 1958 add up to \$48.6 billion. This is over \$10 billion above the \$35 billion tops of the year. Congress has informally set off defense approach them. The outlook is for flat service salary while domestic tax rates go where the cuts must fall.

A substantial part of the Service's information, however, was spent in Democratic efforts to develop the theme that Congress has dominated defense decisions and that Wilson consistently inclined in ordering an increase B-52 production.

Sen. Jackson protested that Wilson waited from May 1954 until January to make his proposal, yet he had been a participant in the April of that year before moving B-52 production from a planned 17 a month to 20 a month. Jackson also cited of W.A.C. Stoen's statement of February, 1954, that Russia was building "defenses" at power.

If that had production numbers in May, 1954, this certainly would have been building them in February, 1954," Jackson declared.

Potrait responded that his statement had been meant that Russia was building "over" defense posture. In 1954, he said, the Defense Department last month that Russia had one from but that "in play at site" had opened a second source of B-52 production at the Boeing Airplane Co plant at Wichita and increased target output from since to 15 a month.

Army May Buy European Aircraft, Engines

By Clerke White

Washington—Small quantities of carefully selected European aircraft, engines and equipment can be purchased by sensible tools to be the U.S. Army because of the cost of fiscal 1957.

No final decision has been made to proceed with the program and, if it is undertaken, it will be the initial project of continuing logistic work in the selected areas.

These areas include STOL and VTOL aircraft, helicopters, landing gear and small turbine engines. The Army believes purchase and evaluation of sample quantities of these products will bring a long return at least in the form of improved technological development in such countries as France, the United Kingdom and Western Germany.

"If we are not finding something hot running along at this point," said an Army officer told Aviation Week, "we could be denied to exclude it from consideration in our planning for the future."

Within the past few weeks, a team representing Army research and development has toured European military bases and factories in search of ideas and hardware that can be applied to Army problems.

At the same time steps are being taken to recruit a new Army Research and Development Laboratory Group at Frankfurt, Germany. The unit established on May 15, operates under Lt. Gen. James M. Clegg, Army research and development chief, and is staffed by three technical officers.

The mission of the Frankfurt office is to have scientific and technical talent of Western Europe to do research work for the Army. Activities as well as other sources will be included.

Europe's Skills

The Army can contacts will be established with selected European research centers, research institutes and industry for performance of basic research.

The projected purchase of certain European aircraft and engines, on the other hand, indicates a growing interest in technological development. It applies to items preferred to foreign materials, such as thin-walled metals or in the case of gyroscopic-controlled fixtures, with support of public funds.

There is a conviction in some Army circles that Europe's industrial leadership in many aeronautical specialties is coming to the forefront with the aid of assistance in the state of the art. In particular, Europe's engineers have been

order recognition in developing aircraft that do not need massive airports. In most cases, these are small airports with superior performance. Perkin's of the small turbine engine has been a proved development.

A Department of Defense committee managing the office of Dr. Clifford G. Jones, assistant secretary of defense for research and development, also has studied European aircraft, landing gear, aircraft with the Army group. The Department of Defense approach is based upon the fact that possibly 30% of the unmet needs and development under way today is being conducted in Europe. Under these circumstances, on behalf of the state of the art we can ignore foreign developments.

French Developments

In further evidence of this was the establishment in August 1952 of a European office in USAF's Air Research and Development Council at Brooks. It is headed by Brig. Gen. Don Flanagan. In some cases it is possible that ARDC's unit will be comprising with the Army's London Group at Farnborough. In view of European facilities the Army team chose special interest in French developments, including that the French army, like its U.S. counterpart, is using several highly ruggedized small transport vehicles. French interest in this type of armament is being stimulated both by combat experience in Algeria, where that are fighting a "guerrilla" type war in tough terrain.

In these battles short-legged

loading aircraft with substantial payload capability would be a tremendous asset.

So would transport helicopters cap-

able of carrying a heavy load and the equivalent to the best road distances and short flights of the North Africa desert.

Turbo aircraft, studied in the Army team included the Breguet STOL transport, the Dassault turboprop jet pro-

jects, the Avions Turbomeca and light-weight fighters designed for NATO, including the Dassault. Also demonstrated was a small landing gear installed on a high performance fighter.

German Progress

In Germany, the group was favorably impressed by the Dornier DO 27 twin propeller STOL aircraft, featuring short takeoff and stop capabilities. Six fifth and control were described as excellent.

The German Helicopter Society, it

was learned, has studied both U.S. and British developments since World War II and is not impressed. The society is having down the ground rules for a helicopter carrying capacity of 10 tons and soon will offer prizes for design of a simple, low-cost vehicle. Improved helicopters rotor systems are one of the major interests of Germany in recent years.

On the other hand British plants, the Avro group became familiar with from Anthony's helicopter efforts. These include a compound helicopter, the Rotafire and a light two-place rotor plane, both driven by tip bursts.

Hughes Family

The Napa family of gas turbines the Elgin, Otto and Gasco are all of low horsepower and suitable for helicopter use. They seem to be strong candidates for consideration by the U.S. Army.

Scintilla Airlines demonstrated both the Elgin engine and single-engine Pioneer transports at Prestwick. STOL performance of the Pioneer was described by Army witnesses as "astounding."

With a twin-turbine powered, the transatlantic aircraft can land and takeoff with not more than 100 yards of sea water.

Special emphasis is placed on British advances in the field of jet tip-propelled helicopters. "There is a lot of activity in this field," one official said, "and it is an important one to us when we are considering heavy loads over short distances with minimum maintenance costs."

Military Support

In addition to a survey of existing equipment, the Army has provided a questionnaire with European military and industry leaders of U.S. and France army requirements. A business and industrial panel for the city of Paris was organized and has been meeting through liaison contracts and the Mutual Weapons Development project.

Avia officials say that with few exceptions, all European manufacturers recognized that the equipment found suitable for U.S. Army use would have to be manufactured in this country through license agreement with an American aircraft firm.

As far as U.S. industry, the Army feels that the most progressive firms are impressed by the Dornier DO 27 twin propeller STOL aircraft offering short takeoff and stop capabilities. Six fifth and control were described as excellent.

Like the Army many of them are eager to exploit advances made in other countries if these will be helpful to the Army program.

Army to Open Contract Proposals For Primary Helicopter Training

Washington—The U.S. Army next will open proposals from training school operators seeking a contract to conduct the primary flight helicopter pilot course at Womelsdorf AFB, Missouri.

Training date for the start of classes at Womelsdorf is Jan. 7, 1957. The base was officially transferred from USAF to Army jurisdiction on July 1.

First steps towards the start of the new limited primary flying pilot training at Cessna AFB, San Marcos, Tex., will be taken this month when requests for proposals are sent out by Air Materiel Command headquarters. The Air Materiel, in this case, is acting as procurement agency for the Army which will get responsibility for the contract after it has been awarded.

Training at Cessna sites will begin in January. Transfer of the base to Army jurisdiction is slated for Dec. 1, 1957. Under Womelsdorf, which will be a military installation, Cessna will be a contractor granted leases.

Secondary studies on the Womelsdorf contract to train cargo helicopter pilots will provide flight and ground school instruction along with maintenance of the mission aircraft. The helicopters will be provided by the Army. The course of instruction will run 15 weeks at Womelsdorf followed in 12 weeks of advanced work at Ft. Rucker, Ala., the Army's Aviation School. Students will be enlisted men, who will become war zone drivers upon completion of training.

Airlift of two million lb. of equipment from Long Beach to Caribbean bases, begun last month by an Air Force C-130 troop carrier aircraft from Hill of the 13 wing, will be begun with 10 more troopers. Cargos, carried in C-46 and C-119 aircraft, is for Coast Guard Loran ships. Lift will continue September.

At French Operational Test Center Toulouse, France, trials of the first Dassault-Druillet fighter, Soustons in Paris, also will be held in the Dassault Mystere IV and the contract reached at 100. In New Delhi, where the agreement was signed after the return from Prime Minister Jawaharlal Nehru's visit to India, the quantity was reported as 110.

Differences are to begin by the end of the year. The Mystere IV, a built by Dassault and built under license, Sud-Ouest and Sud-Est with tool assembly at the Dassault Megeve plant.

India also is considering the Canadair fighter for its jet fighter program. It is a projected visit to Britain this fall to review the service in India and will conclude the visit of an Indo-British agreement for production of the Folland Gnat at the government-owned Hindustan Aircraft Ltd., Bangalore (South India).

Corp. and Lawrence S. Rockefeller, company's two principal stockholders.

Chrysler Corp. has received a \$3,175,000 Army contract for engineering and production work on the project that includes single graded missile. Chrysler also will continue production of the Redstone, Jupiter's predecessor.

French air force has selected expert coastal group of 100 Stal-Gard Trifid light interceptor interceptors.

Bidding of \$3.5 a share for the firm results of the fiscal year on gross sales of \$55 million are estimated by Bresch Aircraft Co. Earnings of \$1.35 for third quarter compared with \$1.20 cents for previous quarter, backlog is more than \$93 million compared with \$54 million as of June 30. Dividends declared \$0.05 quarterly dividend payable July 27.

Napier Elstand NE11 single-spool turboprop engine has passed Ministry of Supply's 195-hr type test at rating of 3,000 shp.

Bidding of seventh orders on board hot radiators is about \$3.5 billion, compared with \$3.5 last year, Conservative Departmental report. Department's two-year survey calls for continuous high level operations as main aim of economy for last half of year.

Hawker-Hoyne Tyne turboprop fighter is under way at firm's flight development establishment at Hatfield. Tyne, chosen to power Vickers Vanguard (AW June 18, p. 47), will fit in Avro Lancastrian test bed. Rolls-Royce Avon will be powerplant of English Electric P.1 supersonic fighter.

Loss of 500 workers by Avro Aircraft Ltd., Tiverton, England, in stretch out production of submarine CF-105 hovercraft enterprise until production of CF-105 begins October 23 follows jet engine, which will power CF-105, has passed 50-hr preflight rating tests.

Hawker Siddeley Nuclear Power Company personnel headquarters have been established at Hawker Aircraft Co premises at Langley Airfield, Bucks, England.

The Airways order for three Super-C Constellations at a cost of more than \$6 million calls for delivery in 1957.

An Faure contract of \$155,250,000 with Ford Motor Co. Aircraft Engine Division at Chicago for additional J37 turbojet engine aircraft division total of 100 units and deliveries to start this fall.



Combat commuter —

at 8 second intervals

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In recent tests duplicating actual combat conditions, Fairchild C-123's gave dramatic evidence of performance under combat conditions.

The target—a rough, irregular field—was ranged by "hailie" teams. Hailies laid down, the C-123's approached the field at 100 ft. altitude—too low for heavy AA guns, too high for anti-aircraft fire. Just short of their touchdown point, the highly maneuverable aircraft transports swept down, firing one set of they hauled over the clearing's edge. Two minutes later, twelve C-123's had rolled to a halt—troops and trucks were racing out to their assigned positions. The C-123's had landed at "8 second intervals."

This dramatic demonstration of pilot and crew proficiency was made possible by C-123 maneuverability, that field performance and other reliability—all these, features of Fairchild aircraft design.

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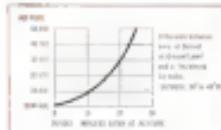
FLY WEATHER-WISE

These weather items prepared in consultation with the United States Weather Bureau

NIGHT FLYING

ON NIGHT FLIGHTS you may have to fly on instruments in haze or smoke conditions, due to loss of horizon. It's also hard to judge distance from clouds, and you may find yourself in them. Keep in mind that fog is more common at night than in daytime. And on clear nights over desert areas some mountain ranges, strong Katabatic winds (cold air sliding down mountain slopes) can reach gale strength. This can make it difficult to hold altitude with available power.

However, as a rule, air becomes warmer after sunset, as vertical currents tend to subside. This is especially true in lower levels.



Remember — when it's twilight at 6000 ft it is already dark on the ground, due to curvature of the earth. Clouds show darker than the land before dusk; determine sunset time and plan flight accordingly.



Watch ground lights at night for signs of landing. This is indicated by lights appearing fuzzy or isolated.

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Cougars in Flight Show Modifications

Underside barge on noses of F9F-5s (below) distinguishes photo reconnaissance version of Navy fighter from F9F-3 (above). Both versions have nose probe for refueling. Top picture clearly shows modified leading edge extension on wing which distinguishes F9F-5 from earlier Cougars. Trailing edges also are extended, adding 19% to wing chord and raising critical flaps setting for transonic flight. Wing lift also is higher than older versions. Photo plane designation with operational markings are F9F-5C. Two other models—F9F-3A—were produced for use in transonic range by Navy.



Airlines Draft No-Show Penalty Program

Two-step ticket confirmation plan provides for no-show fines of 20% of fare; liquor code adopted.

By Craig Lewis

Washington—The airlines have worked out a two-step ticket confirmation and penalty plan with which they hope to solve the no-show problem that has plagued them for years.

Under the plan, airline passengers will have definite time limits within which they will have to pick up their tickets or lose their reservation. A set of penalties has been established for late cancellations and no-shows which have grown to a level of 10% of total passenger loadings.

In separate news, the airlines also adopted a code to govern the serving of alcoholic beverages on all flights between points in the continental United States.

Ticket Deadlines

The no-show plan is scheduled to go into effect in two steps. The first phase, involving short lead times for buying tickets, is to become effective on Sept. 16. Phase two, which involves the penalties, is scheduled to begin Oct. 1. The plan must be submitted to Civil Aeronautics Board approval before it becomes effective.

The first part of the plan is designed to make the airline passenger definitely commit himself to his reservation by purchasing his ticket. Under the new rules, a passenger will have to pick up his ticket before the deadline (which will set in) or his reservation will be canceled.

The carriers are free to establish their own local deadlines, but the plan sets minimum limits. On a reservation made before noon on the last round-trip business day before the date of departure, a passenger will have to pick up his ticket not later than 12:45 p.m. on the day of departure or an hour before departure, whichever is earlier.

ATC Recommendation

The passenger failing a reservation after noon on the last business day will be encouraged to pick up his ticket as soon as possible, but no later than 15 minutes past the end of the day.

Establishment of a two-tiered system raises question of passenger convenience and competitive advantage, and the Air Traffic Conference has suggested a

fee for picking up tickets on reservations made after that time.

The plan the Air Traffic Conference worked out and adopted last month is the embodiment of over a year of study and argument. The same efforts will solve the no-show problem which started after the conference's split decision to abolish the controversial confirmation rule on June 8, 1955.

CAB Threat

Since then, a number of plans have been proposed and discarded. When the CAB met in Washington last month to make another attempt at an working under the flag of a CAB no-show investigation, the Board has been contemplating such an investigation.

An exception has been made to the deadline rule which still permits early arrival service to passengers. Where there has been no cancellation and the cost of a telephone survey order exceeds \$3 or 10% of the ticket price, the rule would stand if an agreement was reached at the meeting in June (AVW June 16, p. 25).

While the various plans for solving the no-show and multiple reservations problems were under discussion, some of the airlines returned to reconfirmation. Ten of the 12 major airlines



Breakfast in Style

Pretty stewardess Beverly Nix offers "heat loaded" to passengers on "Colossus" flights of Western Airlines. Presented in copper chafing dish, it features loaded steak, baked beans, hash brown potatoes and a selection of Danish pastries. Cars are likewise presented on a barbecue which is located in WAI's new shoppe. Lexington dining dishes are featured in stainless steel. Passengers are served a breakfast tray of coffee, fruit and eggs, then served from copper tray. Western says most popular items are steak, with Danish pastries a close second.

The service charge for heat confirmation will not be applied when a passenger gets an earlier flight or flies later than departure, which gets him to his destination before he would have arrived on the original reservation.

No penalty will be assessed for a passenger who buys his ticket after noon on the day before departure. This exception was made to avoid popularity items are steak, with Danish pastries a close second.

earlier fare confirmation as well as past, and they probably will return it to the next day if nothing else.

What is unusual is the No-Show Confirmation Plan. ATC President Arthur F. Kelly, a vice president of Western Airlines, said "the operation of the plan will be subjected to continuous audits and periodic review. The public's reaction, when the plan goes into use, will be solicited."

Liquer Plus

Another problem the airlines have acted upon is the recent fare increases begun to pay for passenger operations have been issued by some private groups and to airline employee groups, and the carriers are threatened with non-guaranteed action.

Airlines which serve alcoholic beverages on their flights have agreed upon rules covering the use of distilled spirits. Wine and beer are not involved.

Under the code, the airlines agree not to serve more than five drinks and one beer per passenger and the drinks will not contain more than 12% alcohol by volume. Wine and beer are not involved.

Preliminary investigation of the alcohol industry indicates that the two arrays collided at 21,000 feet and then exploded into the oxygen.

Flight Plans

The TWA airplane was Flight 2, a Lockheed Super Constellation, flying bound for Kansas City, St. Louis and Washington. It carried 54 passengers and a crew of six. The flight departed Los Angeles at 9:01 A.M. with a planned flight plan calling for the aircraft to fly to Kansas City at 10,000 ft via Sacramento, Denver, Cheyenne, Salt Lake City, Grand Junction, Colo., and Denver, Colo.

The United flight was first class DC-7 Flight 718 bound enroute to Chicago, then on to Detroit, Philadelphia and Newark. It carried 53 passengers plus a crew of five. Flight 718's instrument flight plan was to climb to 21,000 ft and proceed to Chicago via Palos Springs and Needles, Calif. Painted Desert Area, Tucson and Phoenix, Ariz.

The United flight departed Los Angeles at 9:04 A.M. and was assigned an altitude of 21,000 ft. The flight checked in at Needles at 9:35 flying at 21,000 ft.

Before reaching its climb point at Daggett, the TWA flight descended to about 21,000 ft to avoid turbulence. An Air Traffic Control cleared the aircraft to continue its descent and the deadline. C-46 operators are required to show a five minute for the modification work, 15 min. 19:16.

The C-46 modifications were first certified two years ago, but actual work has been delayed until type certificates were issued for the required changes. Two certificates were issued recently, and an application for a third certificate has been received.

AVIATION WEEK, July 9, 1956

Apparent United-TWA Collision Highlights Traffic-Control Problem

The apparent collision of Trans World Airlines and United Air Lines transports in flight over Grand Canyon on June 30 brought to the nation's traffic control problems once again and did little to enhance the situation.

The result of all civil aviation disasters raised a salutary chance for a solution to the air traffic problem, and the tragic accident lends considerable strength to arguments to bring air traffic control up to date and prepare it for the coming jet era.

The accident occurred when TWA and United flights enroute from Los Angeles collided about a mile apart in an isolated area of the Grand Canyon. All 125 people on the two planes were killed.

Preliminary investigation of the accident indicates that the two arrays collided in turbulent air streams generated by the oxygen.

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When the TWA flight was cleared to 21,000 ft high at 9:30, was probably an isolated area, but since the altitude was feasible, it was assumed to be operating under small flight rules.

According to these flight rules the two flights entered uncontrolled airspace above the time they crossed the Colorado River. At that time, the TWA flight probably was about 50 miles east of the Grand Canyon.

Although the TWA pilot was informed that the United flight was in the area at 21,000 ft, there is no record of the location of the TWA flight.

When the two flights collided, they had been operating on different direct routes flight on uncontrolled airspace for 150 miles. A flight operating an uncontrolled airspace gets an advisory from air traffic control that it is likely being in traffic control, but it is largely left to the controller's personal principle of visual flight rules.

Both flights were scheduled to depart early, when they crossed a low-level river, River Colorado and Warner mountain pass. When this failed to report, a search was begun.

The TWA Super Constellation crashed near the bottom of the canyon and can be reached by helicopter during certain hours when the air currents are calm. The United DC-7 struck higher up the narrow wall and is nearly impossible to reach.

Weather Factor

Weather may have been a factor in this accident, and government investigation were attempting to find reliable pilot reports of weather in the area at the time of the crash. A flight of the controller could have been given an altitude setting as much as 1,000 ft. Since they were on uncontrolled airspace the flight would not necessarily have responded a switch to instrument operation in bad weather.

Both the CAB and the Civil Aeronautics Administration have sent two-level teams to investigate the crash. William S. Andrews, Chief of the CAB Bureau of Safety Investigations, is directing the investigation with Leon Torgau, Chief of the Bureau's Technical Division, supervising the investigation at the accident site. Also assigned to the investigation are W. DeLoach Markey of the CAB's Washington office, Leon Coddickhead, and Earl Mitchell of the Oklahoma office; George Hobman of the Santa Monica office, and R. P. Parshall, of the Kansas City office.

Deputy Administrator James Pele Nels of CAB's GMA group which includes

W. B. Moulton, W. B. Davis and D. D. Thomas.

The Good Government crash produced considerable criticism and demands for action in both houses of Congress. The House Interstate and Foreign Commerce Committee threatened legislation to force the Transportation Department to establish a comprehensive system of air space rights problems in its investigations of the TWA-United accident.

A subcommittee has been set up under Rep. Oscar Harris (D-N.Y.) to investigate the probe. Rep. Paul Pastore (D-Mass.), chairman of the Commerce Committee, said that the study would expand the committee's legislative responsibilities in handling air traffic.

Sen. George Smathers (D-Fla.) wrote Sen. Wayne Morse (Oregon) and Sen. John Sparkman (Alabama) to advise the Senate to take action. Senator Morse said that the study would give the Senate the chance to determine whether the agency's operations are sharing ahead of the growth in air traffic.

An event review of air traffic problems by a subcommittee of the House Government Operations Committee already was under way before the TWA-United accident. Testifying before that group, Clarence Saven, president of the Air Line Pilots Assn. and the U.S. and airline pilots' association, said that they are "operating under a rule that is incapable of performance."

Shutdown or Revise ANDB, Arnold Tells Subcommittee

By L. L. Doty

Washington—Milton W. Arnold, vice president of the Air Transport Association, urged last week that the Air Navigation Discrepancy Board be either abolished or completely reorganized. The present ANDB, Arnold said, is "dead and smells rank."

Testifying before the House Government Operations Subcommittee, Arnold also made three pointed recommendations:

- Called for the elimination of the Technical Discrepancy Center of the Civil Aeronautics Board administration.
- Charged the CAA with a task of its own thinking and planning.
- Asked government agencies of setting up sole judgment on airspace violations.

CAA Leg

Arnold stated authoritatively that proposed legislation which would establish a 16-member commission to seek a solution to current aeronautical problems. He endorsed the suggested measure with the House Committee which, he said, had enacted "reams of paper but very

little improvement" in governmental organization.

There is nothing wrong with the basic concept of the CAA and its legal function in the control of traffic, he said, and added. He added, however, that the CAA program for the development of electronic and navigational devices is geared by funds and deadlines to the requirements of aviation in 1935.

He called the CAA free-expansion traffic control a "patchwork" approach and favored the Technical Development Center of being "appropriately" 10 to 15 years behind in money, facilities and staffing.

Around and application of known techniques can bring about an improved instrument system without increasing the number of hours of controller personnel. Such a plan, he said, as a dynamic leadership suggested in adequate budget allowances. His suggestion for safe separation and coordination of aircraft withheld.

ANDB Traffic Control

• A new method of man-interactive visual communication between the pilot and controller to reduce voice communications.

• A method involving an "electronic receiver of data such as wind speed, position, altitude and direction which can be automatically displayed before the controller.

• Expansion of radar facilities.

• Airport landing distance lights.

• High-intensity approach lights.

To clinch what he termed the "argument," he added, "the ANDB will be discontinued." With the understanding that the airline industry was interested in all but two of 22 recommendations before the panel at Jan. 1, 1954, he was asked to consult with the panel in writing of the cases. "Exceptions of the sort exist, but such discussion," he said, "cannot be tolerated."

Tacan Dispute

The Tacan VOR/DME range is controversial. Arnold said because there is no final judge, to decide on the merits of each system. If the military goes then stated need for Tacan, he continued, the airline industry has no choice but to accept it. On the other hand, Arnold and VOR/DME is preferred by the industry because it is less expensive and lead time is considerably shorter.

During the hearings, Arnold maintained that he could eliminate the service accident involving Texas World Air Lines and United Airlines in an adequately spaced transcontinental system. An well-rehearsed argument, using no determination of cause can be made of all the facts as known.

Arnold did say, however, that no biomeister provided as solution to

anti-collision problems. Tests with both radio and television, he said, have proved inadequate because of the three-dimensional factors in aerial traffic control.

Arnold said the excess air space required for safe separation in radio's system is an enlargement of communication range and lack of up-to-date anti-collision equipment. Tacan is described as more radio, a fairly limited system where a pilot must listen to all calls to be sure he will encounter those intended for him. We haven't even added the handicapped Bell telephone of 1950, let alone either a local or long-distance dual system."

Capital Gives Viscount Expenses, Load Factor

Washington—The break-even load factor of Capital Airlines' Viscount transports is less than the average for the company's piston-engined aircraft. Operating costs of the new aircraft are slightly above original estimates.

Total mileage costs of the Viscounts were reported at \$1.75 per mile, compared with an original estimate of \$1.54. The breakdown load factor was at 76.4% with Captain President J. H. Carverhead and disappearance expenses will decline, again, per mile, when the Viscount fleet is at full service and the utilization rate reaches eight and one-half hours.

Direct operating costs were reported at 79.2 cents per mile, while indirect costs were reported at 79.2 cents per mile.

Carverhead reported the Viscounts' average speed at 299.4 miles per hour as compared with an originally estimated speed of 279 mph.

The airline president also forecast that the break-even load factor will level off at a point somewhere between 75% and 85% and that total costs will be below the original estimate for a long period to come."

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If the two groups are successful in presenting their nominees before the November election, it will be the first time that Sayen's position has been contested during his five years as officer. Conventions are held biennially and offices are elected for two years.

In a resolution passed at American Airlines' annual meeting, Captain W. H. Dwan, president of the American, proposed that the board elect an executive director for American pilot for 16 years and has been active in ALPA affairs for the last 10 years.

Support for Sayen

• Pilots of United Airlines have appointed a committee to recommend a United nominee for the office. The two names do not necessarily reflect the views of other airlines will follow suit and pick candidates from their own ranks.

Sayen is not without his opponents. Pilots of several airlines have voted

American, United Offer ALPA Candidates in Move to Oust Sayen

Washington—The move to oust Charles Sayen as president of the Air Line Pilots Association gained force last week as plans of the two major airlines to nominate their own candidates for the union's top office.

If the two groups are successful in presenting their nominees before the November election, it will be the first time that Sayen's position has been contested during his five years as officer. Conventions are held biennially and offices are elected for two years.

American Resolution

The American Airlines resolution said that there are signs of some unrest, and that these "signs to be a desire for change in the organization."

Sayen, a former United Airlines pilot, was elected president of ALPA in July 1951, succeeding the late David Belisario. Belisario was ousted from the post shortly after he had fired Sayen as ALPA executive vice president. A strong rival for ALPA president, Sayen's appointment as chairman of the legal section to replace the title left to Sayen. Belisario was founder of the union and served as its head for some



N. Y. Starts Heliport Construction

Long-delayed construction of Manhattan's first commercial heliport was begun last week by the Port of New York Authority after final agreement with city-based West of West Street site at \$44,321.80 for first year, increasing to \$71,658 for fifth year. The \$12,000 experimental facility will be completed in September. New York Airways will use it first for mail and cargo and later for passenger helicopter service.



Over \$1 million in the form of radio-prop Vickers experience will be had with the Viscount 810-840.

the new 400 mph turbo-prop

VISCOUNT 810·840

designed for greater profits and economy

The Viscount 810·840 is designed to cruise up to 600 miles an hour at 20,000 feet. Carrying up to 70 passengers, it will be the ideal aircraft for medium-haul, high-density routes. Higher speed and enlarged capacity are combined with greater engine economy and relatively low fuel cost to give the Viscount 810·840 its unique advantages. Powered by four new Rolls-Royce Dart R. B. 6, Tex R. B. 8 turbo-prop engines, the new Vickers Viscount 810·840 will be put into service by Continental Airlines in 1958.

By then Vickers Viscount aircraft will have renewed more than a million hours of flying experience.

Behind the new Viscount 810·840 stands the great mass of the Vickers Group—renownedly famous in makers of aircraft, ships, industrial machinery and precision equipment.

United States Representative: Christopher Cleghorn, 10 Rockefeller Plaza, New York 20, N. Y.

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twenty years until objectives to be met were almost in sight.

In July 1952 Braniff won a trial decision in a Chicago U. S. District Court naming the legal predecessor of ALPA. Braniff promptly announced that all contracts negotiated under Savar were illegal and that no pilot could negotiate with airline route against violation of Braniff's rules.

Soon after the signing of 90% of the pilots of eight tank and international airlines signed a separate union, the Air Transport Pilots Association.

At the same time he asked the U. S. Circuit Court of Appeals for a stay of the order granted Braniff.

The stay was granted in November 1952, and Savar was reelected president of ALPA to the same month.

CAB Gives Mackey New Havana Route

Washington—A formal removal of Mackay Airlines' licensing authority and expansion of the airline's route to Havana and new points in the Caribbean has been granted by the Civil Aeronautics Board and approved by President Eisenhower.

The CAB added a new route between West Palm Beach-Palm Beach and Miami, Florida, and Nassau to Mackay's system and added the Bahama, Cuban, Abaco and Eleuthera Islands, British West Indies, as intermediate service points in the carrier's old route.

Mackay's three remaining routes between Tampa and St. Petersburg, Fla., and Naples B. W. I. via West Palm Beach-Palm Beach and Ft. Lauderdale was renewed for the year. The CAB said Mackay's renewal has been converted and rebuilt.

It also ruled that Mackay's operations are in "continued growth and financial improvement" and that no service had to be withdrawn adverse effect on no other airline.

In reviewing Mackay's authority, the Board rejected applications of National Airlines and Eastern Air Lines to take over the smaller carrier's routes. The CAB said that the greatest need is for the type of service Mackay offers, and that there isn't enough traffic for competitive service.

The CAB renewed its authority for Mackay only on the duration of the new authority. The examiner report stated a three year renewal, but the Board felt with a short period would fail to give the airline enough time to establish itself in its markets and decided to renew the certificate for five years.

CAB-Braniff Compromise Dispute; Airline Can Drop Minnesota Stop

Washington—The Civil Aeronautics Board last week decided to compromise with Braniff Airlines in its dispute with the International Commission of the Seven States ports in North Dakota, South Dakota, Nebraska and Minnesota.

The CAB decided to make Braniff's conference on one North Dakota, S. D., and Northfield, Minn., and to provide service between Sioux City, S. D. and Fargo, N. D., via Bismarck and Watertown. The airline had planned to discontinue all these services. The Board decided, however, to allow Braniff to drop Watertown, Minn. from its route network.

At the same time, the Board began a new investigation to choose a local service airline to serve the partly Frontier Airlines, North Central Airlines and Clark Air Lines have filed applications for system routes to the west and the CAB has expanded its own choice to reflect Board.

Braniff's application to serve the route expired June 30. The CAB is requiring the airline to submit its plan until 60 days after the Board makes the decision of a specific route to Fredrick Eisenhower, Edward C. Curtis. The task force could work in the field to solve the pricing problems of an unregulated service and facilities.

The U. S. proposal has attracted great interest at the conference, which is being attended in 263 delegations representing 52 countries and eight international organizations. It is recognized by the ICAO members that present facilities fall short of fulfilling current transport requirements and that the loss of possible consequences of the abandonment. The situation, the delegations believe, will become still more serious in view of higher performance equipment introduced into the commercial airports. Some effort must be made to encourage and acceptable solution is urgently needed and it is hoped that the task force plan may provide one.

Israel Complains; Arabs Jam Air Communications

Tel Aviv-based has complained to the International Civil Aviation Organization meeting at Cannes, that Arab nations have been pressing ground-to-air communications of Israeli airports and refusing permission to planes or aircraft bound for London.

Israel also practiced "obstructive tactics" by the Arab nations, including the blocking of establishment of a regional Middle East flight information center.

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DERD 2487

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This supertanker appears on the nacelles of Rolls-Royce "Dart" turbo-prop engines—the famous engines that power the Vickers Viscount. A synthetic lubricating oil is specified because no existing mineral oil—not even those of the highest quality—can meet the Bell-Harper requirements. Several years ago, Esso Research, working closely with British and American aeronautical engineers, tackled the problem of developing a suitable lubricant for aircraft gas turbines. Result: Esso

Aviation Turbo Oil 35—a synthetic oil with all the outstanding lubricating properties needed for Rolls-Royce and other leading aircraft turbines engines. And today, Esso Aviation Turbo Oil 35 is still the only approved lubricating oil for the Viscounts' turbo-props.

The development of Esso Aviation Turbo Oil 35 is just one more example of Esso's continuing leadership in creating new and better fuels and lubricants for the new and better aircraft of today—and tomorrow.

8 OUT OF 10 OF THE WORLD'S INTERNATIONAL AIRLINES USE



Brisbane, Pittsburgh and Detroit via Wheeling, W. Va., and Louisville, Mansfield and Toledo, Ohio, at the request of the applicants.

DENVER

North Central Airlines' petition for a waiver of restrictions on security measures for certain air traffic controllers for the period July 31 to Sept. 14, 1964, a period when informal and intra conferences involving North Central will be held.

Shortlines

► **Braniff Airways** has ordered Bendix RDR-1 airborne weather radar for installation on its fleet of DC-7C aircraft. Delivery of Braniff's DC-7Cs is scheduled to begin in September. Braniff's 91-hour diversion has cost a dividend of 15 cents per common share for stockholders of record as of July 5.

► **Calgary, Alberta, Canada**, has opened a new \$1 million terminal at its new airport. The 1,400-seat airport has a 6,000-ft. runway, parking apron, and its various facilities include 8,029 and 5,400 ft. runways.

► **Cubana** has ordered four Viscount 810-48 turboprop transports for delivery late in 1968. The Cuban airline has three Viscount 700s in service. Viscount sales now total 327.

► **Hawaii Airline Chambers Committee** has a campaign to convince the Civil Aeronautics Board it should allow the airlines to absorb local fares between Honolulu and island points in their West Coast Headlines. The idea was tried out for a few months in 1960 before the CAB clamped down and made the carriers give it up.

► **Italian Study Comittee** completed a program for establishment of helicopter service in Italy. The plan calls for a new Italian company to operate an 850-seat system starting in 1966-67 with flights between Rome and Naples, Naples and Capri, Naples and Sicily, Sicily and Ancona and Rome and Sicily. In 1967-68, the plan calls for expansion of services to Viareggio, Rapallo, Genoa, Monte Carlo and Nice.

► **Louis Armstrong Venezuela** plans to extend its Southwester Panair service to Maracaibo and Guayaquil this year. The Venezuelan Government is reportedly completing negotiations for the new service.

► **Mexico** is spending \$720,000 this year for improvement of its airports and repair of airport air strips.

► **North Central Airlines** will reduce

immediately all of its 11000 50% dividends due July 31, 1964. The dividends are convertible to common stock at the rate of one share for each \$3 principal amount of the dividends.

► **Oakland** has published a Flight Selector in precision lights at Mexico's new Oakland International Airport. The selector affords easy reference for information on 180 daily flight areas in and departing from Oakland.

► **Rancho International Airport** of Fresno has received a \$15 million appropriation from the Urban Mass Transit Authority of Peoria Works to complete the work authorized under an original appropriation of \$27 million.

► **Seattle-Tacoma International Airport** handled 107,700 passengers on May 16 compared to 96,551 in May, 1963. The airport handled 450,243 passengers during the first five months of the year, an increase of 35,070 over the same period of 1963.

► **Twa World Airways** will operate 195 domestic flights daily this summer with 52% of its seats sold in tourist

stroke. The airline will have 166 flights a week in international service with 58% of the seats in tourist fares.

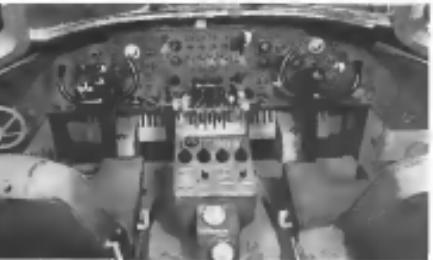
► **Varig Airlines** of Brazil purchased two Lockheed 1649As for delivery between December, 1965, and February, 1968. The new airplanes will be used on Varig's Buenos Aires-New York route.

Improvements Made On Fokker Friendship

Improvements in the previously mentioned flying and takeoff characteristics of the Fokker Friendship transport aircraft have been reported by Fokker following the evaluation of data from a test program.

Fold length for landing under an air load, standard atmospheric conditions now is attained at 3,000 ft., compared to 3,800 ft. previously estimated by Fokker.

Takes off runway requirement with an air weight of 34,520 lb. is now estimated at 3,850 ft. Previous estimate called for 4,300 ft. of runway.



DC-8 Cockpit and Engineer's Station

Arrangement of instruments for new Dash 8 in DC-8 jet aircraft follows recommendation of the Society of Automotive Engineers Aircraft Committee. Primary flight instruments and controls are located at the pilot's station center with two integrated flight instrument systems on each of the pilot's panels. This is to lessen interoperator errors and increase safety of pressurized aircraft systems. Engineer's station flight has separate panel dedicated to systems instruments and controls.





1916 Model C propeller-driven national air mail service between Seattle, Wash., and Victoria, B.C.



1927 The Boeing 40, a mainstay of American carrier airlines in transcontinental and passenger service.



1932 The 247, first 3 with a remote air horn, revolutionized flight for all modern twin engine transports.



1936 B-17 Flying Fortress, first modern heavy bomber fleet introduced aerial warfare.



1939 The 707, America's first jet transport, prototype transonic. First liquid engine aircraft in transcontinental service.



1942 B-29 Superfortress, world's first nuclear weapon carrier, became backbone of America's heavy bombardment force in the Pacific during World War II.



1944 The Stratocruiser, unique double deck aircraft, based on Boeing's famous Boeing 307, flew nonstop from New York to San Francisco in 13 hours, 30 minutes, more than 30,000 nonstop flights.



1947 B-47 interceptor Stratofortress medium bomber, America's newest front line nuclear weapon carrier, being refueled in the air by a Boeing KC-97, attached aerial tanker of the Air Force.



ROMARC: Supreme mobile missile, designed to strike enemy targets with still unspent warheads from vital targets. Performance details are secret.



1952 B-52 eight-jet Stratofortress, world's leading intercontinental bomber, based over 65,000 ft high. Operating altitude above 30 miles. Described by Cuban officials as "the most terrible massacre of air power in the history of military aviation."



1956 The 707, America's first jet transport, ordered by eight airlines for delivery beginning late in 1958. Prototype built transcontinental transport model: 3 hours, 50 minutes. KC-135 configuration will be world's first multi-jet aerial tanker.

Here, chronicling an era of aviation achievement, you see America's first jet transport—along with other Boeing firsts that have marked significant advances in aircraft performance.

Each is a product of ingenuity, Boeing design and efficient production. Behind each aircraft is a tradition of leadership that began 40 years ago this month, when Boeing was founded. During this span, Boeing created a succession of epoch-making aircraft.

In **Commercial Aviation**—the passenger 404, and the 247, first modern 3-cabin-a-minute airplane; the 304 flying boat, the original Stratocruiser, first pressurized transport, and the historic Stratovairliner, familiar around the world.

In **Military Aviation**—such trend-setting fighters as the P-80, the revolutionary B-9 bomber, which could outspeed any contemporary fighter; the historic B-17 Flying Fortress and B-29 Superfort, engineering in radar's revolutionary B-47 and B-52 nuclear bombers.

And for **Tomorrow**—the 707 Commercial Jet Transport, the military KC-135 jet tanker-interceptor, and the defense weapons system based on ROMARC, Boeing's long-range, pilotless interceptor guided missile.

Boeing's 40-year tradition of leadership continues to help keep America first in the air.

BOEING

Corporal Gives Army Nuclear Capability

Missile system provides artillery, gives commander striking force capable of delivering nuclear weapons.

By David A. Anderson

El Paso, Texas—The Army's Corporal short-range surface-to-surface ballistic missile is one example of a missile you won't find in a store.

Originally the Corporal was the Corporal 1, a research rocket and part of a joint effort by Army Ordnance Research and Development and the Jet Propulsion Laboratory of the California Institute of Technology. A task program took the Corporal out of the research category and into field operations. Production of the system was delegated to prime contractor Firestone Tire and Rubber and Galileo International.

During the past year, eight Corporal battalions have been delivered to the Army and all of these have been deployed to Europe. Some of the T-4000 units will be moving back soon for refitting with Corporal 2 equipment, or improved to their new in-production form for the Army.

Guided Ballistic Missile

Corporal differs from earlier ballistic missiles such as the German V-2 because it is guided after the motor is cut off as well as during the powered portion of the trajectory. The V-2 guidance system is based on a lifting ridge with the powered flight rate continually programmed before the rocket fires free.

Corporal also follows a pre-programmed path, but its flight path is corrected by signals from the ground. Ground control data is compared with the information from Radar signals from the ground via cut-off of the propellant at the correct missile velocity, lead-in, a range correction velocity signal, and now the warhead at the time of stage separation.

The only of the world's first guided ballistic missile, says the Army. This statement assumes—perhaps naively—that the Russian has not yet gotten around to improving the V-2 guidance system.

The Corporal battalion is a means to an end. Its mission is to provide guided missile artillery fire in support of a field army. This kind of an operation places the Army commander's mobile striking force with nuclear-warhead capability.

Approximate maximum range of the Corporal is 10 mi., but missions can be

directed against targets of closer range. The missile battalions have all-weather capability, although there is a certain amount of optical tracking equipment that is a valuable aid during good visibility.

The Corporal consists of XM-481 in the Army designation, which is part of a tested weapons system that includes complete handling, servicing and maintenance equipment as well as the necessary escort, launcher and guidance gear.

Length of the missile without fins, diameter at nose cone, is 30 in. The total nose cone is 30 in. which can be varied to suit the tactical problem. Just behind the nose cone is the guidance package, containing most of the avionic equipment in the missile.

The payload section behind the

warhead guidance package houses a tank which holds the high pressure air used to feed the propellants to the motor; separate valves and vent the propellants.

Cuts the fins and motor fairings. Launch fins from the noseplast out along the outside shell of the missile in angles other than through the center of the finless tail. The fins are visible in the picture.

Just like the Corporal's rocket motor is never effective, the oxidizer is not burning during ascent. The combustion of the fuel is a propulsive loop-pole self-starting so that as soon as they meet in the combustion chamber, ignition takes place spontaneously.

The rocket motor is mounted in the aft section. Four very small triangular fins support the aerodynamic stability and also form part of the supporting structure. Two heat shields get warm which protrude into the exhaust jet for cooling during the powered phase of flight.

Three small tail surfaces represent the major external change from the Corporal 1, which had much larger horizontal fins and rudders.

Battalion Organization

Initial complement of a Corporal battalion is 240 officers and men, divided into two battalions. One of the battalions is responsible for the complete technical operation of equipment and the missile knowledge. The other is a headquarters battalion with administrative responsibilities.

This organization is a direct change from the former setup which had two firing batteries and one safety battery under the battalion. The change was made last September for greater operational flexibility.

There are three general categories of enlisted personnel in a battalion:

- Operators, who handle the specialized equipment in the tactical problem
- Maintenance and repair, who are trained for field use of the equipment
- Commissary specialists, such as cooks, clerks and motor personnel.

Operator personnel total 94. Of



FIRST PUBLIC Firing of Corporal missile at White Sands was witnessed by hundreds of visitors about a month ago. A test program took the Corporal out of the research category and into field operations.

Approximate maximum range of the



HIGH ON THIS XM-481 Missile Battalion, Ft. Bliss, Tex., stands a special steel mount, made of Polyethylene, during loading of Corporal.



HANDLES OF Battalion using remote control box to meet Corporal on launcher.



CREW makes final check before firing.



THE XM-481 Missile Battalion carries its Corporal mobility base, truck equipment.

them, 27 are launching crews, eight are electronic specialists, 10 are maintenance crews and 20 are firemen. These men form the major part of the bio-planners—one for firing and one for guidance—that make up the battery.

Field Checks

A Corporal firing battery makes up its initial area in a sector composed of a series of vehicles and trailers. These are arranged in fire sites, checklist, steering, guidance and launching.

The majority of reusable containers, their warheads and projectiles have been transported to the battalion storage dump by ammunition train from the Ordnance ammunition supply depot. Procedures for handling roads of this and other Army missiles are the same as for solid-state or artillery round munitions. Logistically the Army must

handle 30,000 pounds of

standard flatbed trailers and trucks are used to move the rounds from the dump to the checklist area where the Corporals are placed on handling racks.

Like big guns, they require a special track-mounted trailer. Standard trucks do not fit the batteries around on site here.

Mechanical and electrical checks are made on the missile before the missile is fired from the checklist area.

The big 20-ton LaFrance carrier transports up to the checklist area with its heavy-duty truck for short-haul transport of the missile from here until it is fired. The power train is a gasoline engine driving DC generators, which in turn drive electric motors. Each gigantic wheel is powered by a separate DC motor for individual drive. Sixty-four motors handle the tasks of steering,

travel motion and control of the gun and the other systems in the control vehicle.

The driver keeps out and takes a remote control box from the rear section of the carrier. He can completely control the velocity from this unit and can move it or the missile with an accuracy of a fraction of an inch.

Corporal Servicing

With the Corporal secured to the bottom of the carrier, the vehicle has been to the serving area for propellant filling and warhead setting.

The carrier operator swings the boom through a 130-degree arc to position the Corporal horizontally behind the carrier for the fueling operation. Fueling is powered in their protective sheltering pit using the two tanks for the operation.

Four barrels of amber, mounted on

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We invite you to consider the California Division of Lockheed Aircraft Corporation in the place to re-establish your career. For these reasons:

Promotional Opportunities are excellent because there are so many supervisory positions to be filled with 45 major projects in progress at Lockheed; and because Lockheed is an expanding development and production program.

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You may receive a substantial increase in pay because Lockheed is extremely liberal in raises, salary and in extra employee benefits, which actually increase the value of your position by an average of 14%. Moreover, engineering salaries have just been raised 5%.

Positions are open at all levels for engineers in fields of: Aerodynamics — Design — Performance, with emphasis on systems and structures; Propulsion — Flight Test Engineering, particularly in instrumentation; Math Analysis — Operations Research — Structures — Thermodynamics — Wright.

Space prevents us from listing all the reasons we believe you will find significant. There are many others. But if our brief remarks make sense to you, write us and we can explore your opportunities at Lockheed through personal interview or phone. The best reward however is simply for your confidence in contacting us.

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Home phone

a single track, turn the tail for two outside turns. North, two spherical tanks of self fluming aromatic acid, also mounted as a single track, are ready for emptying onto the Corpod.

Standing by are safety personnel with a fire truck, a water truck with a 1000-gallon tank, and an ambulance. Propellants will be stored from the ground-mounted tanks. Domestic hoses, strapped onto the fueling tracks, are used to wash down the area if either fuel or aviation oil spills.

Both fire department RIFPA's begin assistance and protection soon begin. An hour is a skin instant and has these hoses.

A standard Army M246 rocket is driven up, towing a Long Crash and Track XM114-15 warhead trailer running two Corpod warheads. Once a visual from the trailer in the mouth of the trailer cradle and over and in there.

The trailer is towed away.



the F-104A goes steady with Lear

The fastest man-thought speed of the Lockheed F-104A Starfighter has been made practicable by the automatic flight control system designed

and produced by Lear in collaboration with Lockheed engineers. By damping out unwanted oscillations in all axes more quickly than they can even register in a pilot's brain, Lear's 3-axis stability augmentation provides an ease of control comparable to a basic jet trainer.

(See in
Santa Monica, California)

—



there would be another jar of epoxy until the instrumentation van.

After each part of the system has been checked as an individual item, the complete system is checked and the plasma is ready for X-30 runs.

Last Half Hour

The jetman moves to target by phone from the Army commander in field control of the program or a test director. The controllers are repositioned and the firing table determines the flight path for the missile.

Battery power takes over. The speed-up starts the countdown of the last thirty minutes. At an command, the base will be X-30 minutes...X-30 minutes...Mark! That is now running at X-30 minutes.

At X-30 the final operations begin, first separated from the latter control station. The site servicing tracks move in and prepare the missile to 2,150 psi in its tank. The servicing platform moves in also and two techs secure the boom to the guidance section, make a quick check, and come down again.

Both the missiles the latter hours have been tested until the two meet at X-0 seconds. Then the spent missile is a one-minute interval. The launching arm is closed, behind the undamaged dagger the firing officer had

done, saving touch for the shock of ignition, the ringing of the rocket within the firing nozzle.

The final countdown is by seconds to the zero mark, then by letters through the four-second period after the firing button is pushed and before the missile is airborne. The count goes through the numbers — Four, Three, Two, One, Zero. Then — the values of the upper and the air free of atmosphere shows the velocity curve, and the end ascent rate and through the lines toward the system.

Off—the guidance data through the angular lead meet in a curve. This nozzle can be seen the first signs of smoke and the first noisy break through the sparkler cover.

Off—the motor is roaring like Niagara like a wild Niagara now to your ear like a thousand screaming women. The dust follows away in rushing clouds from the base of the launcher. Shock and wave and shot pebbles split against the sandbags.

"Off"—and the Guidance lifts off the stand balanced on a pillar of fire and accelerates smoothly upward.

Eyes Here It

Over in the guidance station the black eyes of the tracking radar have angled out the slot shape, hunting up west and have positioned it is quiet



Nacelle at Cornell

Lockheed Electro power package built to 0.37 scale has been fitted on the propeller dynamometer at the 12 x 12 ft variable density wind tunnel of Cornell Aeronautical Laboratory. The test was conducted at the transonic condition of Mach 0.75 and maximum tip speed of Mach 1.4. Tests included investigation of the effect of propeller configuration factors considered as dominant and the generality of the blade element method on propeller performance. Studies were also made on the effects of these parameters on air inlet duct performance and generate recovery of the engine compressor face. Cornell also has completed 50 hours of stability and control testing on a 1/4-scale model of the Electra



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the engineer
who can fit?



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Electro-Reliability

Electro-Space

Electro-Systems

Electro-Testing

Electro-Transportation

Electro-Vibration

Electro-Welding

Electro-Workshop

Electro-Assembly

Electro-Inspection

Electro-Testing

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Electro-Reliability

Electro-Optical

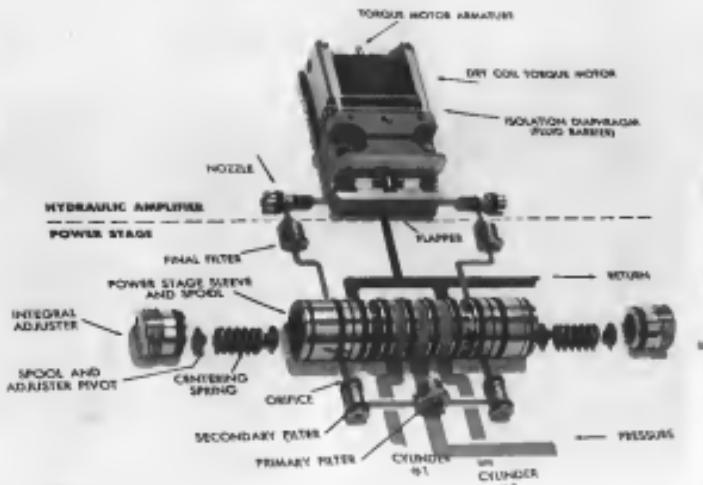
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AND MANUFACTURING COMPANY

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HIGH PERFORMANCE STABILIZATION
AND CONTROL SYSTEMS



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The Hydraulic Research Dry Coil Servo Valve utilizes an isolation diaphragm that acts as a fluid barrier permitting coil and magnetic clarity to operate in air for peak efficiency without danger of contamination.

Added assurance of trouble-free performance is provided by five internal microfine filters of corrosion-resistant steel. All coil passes through three stages of filtration before reaching hydraulic amplifier.

Null adjustments, centering springs and control spool are all housed in the power sleeve. All are stainless steel and are not subject to different coefficients of expansion. The result is excellent null stability under all conditions. Integral construction of sleeve and adjustments, and micro finishes reduce valve hysteresis and threshold to absolute minimums with increased valve life as a by-product.

The Hydraulic Research Dry Coil Servo Valve is available in quantity for high performance flight control systems.

WRITE FOR ADDITIONAL ENGINEERING INFORMATION



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CHALLENGING ENGINEERING POSITIONS OPEN



Convair Improving F-102A for USAF

Convair's F-102A delta-winged all weather interceptor is receiving rework by many of the industry's pilots who have flown it in combat, and a new system that has an outstanding potential.

Evidence of the basic capability of the craft lies in the announcement that the company is starting production of the F-102B, based at over greater weapon payload than the A (AW, June 11, p. 50).

The powerplant for the B series will be the Pratt & Whitney J57 rated at the 15,000-lb thrust class. One expected advantage of the new engine-plus-plat combination will be improved altitude capability to cope with the reported operational altitudes of 57,000 ft, reached in the Rantan long-range Binson balloon.

Other changes that can be expected in the F-102B include improved airframe, redesigned vertical tail (the current vertical tail is in a T-skin) and is being replaced now with a larger surface), and a fuselage conformal fuel tank according to the air force's stated need for better braced and blunted.

F-102As are now being delivered to operational squadrons. The first unit being equipped is the 337th Fighter-Interceptor Squadron, which is presently based at George AFB, Calif.



New Fastener Created By American Screw

Wilmington, Calif.—A new type of screw fastener is being used by North American on their F-100s, according to officials of the American Screw Co. here.

Called Tap Set, the fastener features a specially slotted head which will permit 50% more torque tightening forces.

This allows the fasteners to be pulled up past the point where they are altered by vibration fatigue, says American Screw.

What at first looks like a slightly slanted version of the American Screw Co. conventional flathead turns out to be a much refined shape designed to both hold the tapping tool in place and give it something to work against. At the same time, says American, the redesign actually improves the fastener's resistance to impact.

A special driving tool is needed for such fastener use.

Torque-tight, where a Phillips-head driver would pull out and chew up the screw head at 50 lb/in. on a 1-in. screw,



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PRECISION TITANIUM FORGINGS

from Canada—at much lower cost

An entirely new forging process for Titanium has been developed by CSI, Canada's foremost forging and casting company, operators of blades, buckets and forged components for all engines. The new process enables CSI to produce Titanium parts of the highest standards at the lowest prices in the world.

Here are some of the characteristics of Titanium forged by the new process:

- Precision tolerances.
- Complete freedom from surface embrittlement due to gas/metal contamination.
- Excellent surface finish.
- Greatly reduced machining costs—for example jet blade surfaces require polishing only.
- Convenient quality monitoring.

Besides taking the lead in Titanium, CSI are also highly regarded and experienced in the production of high-temperature alloy forgings and in forgings or castings of aluminum and magnesium.



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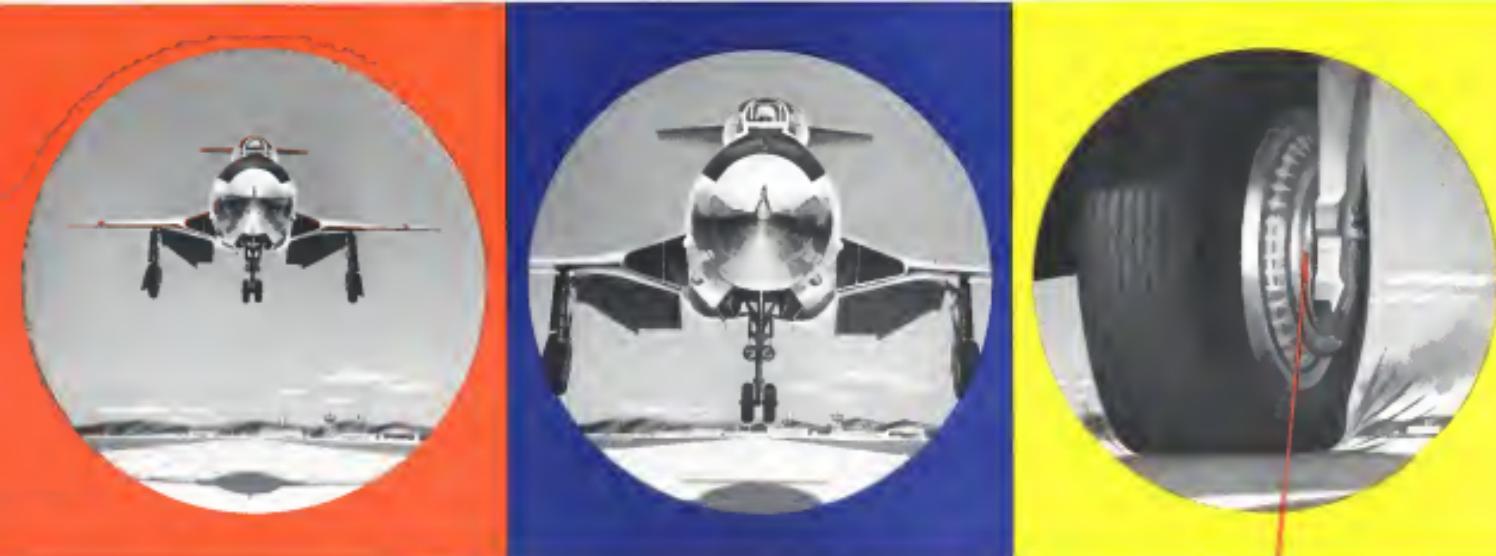
C. F. RUSSELL COMPANY INC.

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CSI

AT THIS MOMENT



WHEN PRECISION COUNTS MOST YOU CAN DEPEND ON **GRUEN** PRECISION[®]

Flops down...runway clear...speed 130 knots! This is the moment of touchdown! This is the moment when precision counts most!

MINISTOP by GRUEN—precision goes smaller in diameter than your fist—takes command at the instant of touchdown! Its precision electric mechanical linear reliability aids the pilot as he brings his aircraft to a smooth, gently rolling, pilot-free stop. It's another example of Gruen precision you can depend on!

MINISTOP by GRUEN is no far weather friend, either! It can plainly ignore blinding snow, sleet rain, mosquitoes etc... or por karm with larvae. Gruen precision checks! Stopping distance is

reduced as much as 20%—automatically! The pilot is free to concentrate on other vital duties. Greater overall safety is ensured. **MINISTOP** by GRUEN is lower-priced, lighter and more compact than any other anti-skid device. Installation is easy and economical—maintenance practically nil. Take take less power-absorbent for longer. And the **MINISTOP** has been fully tested and proven under the most rugged conditions.

Made only by GRUEN in this country, **MINISTOP** is in use right now on landing aircraft throughout the world... increasing safety and comfort... decreasing operating costs. Could **MINISTOP** do the same for you? Why not contact us today and let our engineering staff give you the complete story.

Whatever your problems... whatever your problems... when Precision Counts Most... You Can Depend On



THE MINISTOP by GRUEN

... world's lowest-priced, lighter, smaller, newest in anti-skid device. Another product of famous Gruen precision.



PRODUCTION ENGINEERING

Big Airframe Forging Challenges Martin

The aircraft industry may have to re-think its machine shop equipment in the light of the Glenn L. Martin Co.'s recent success in machining the largest piston airframe forging fabricated yet for aircraft use.

The 2,500-lb. forging is a wing spar section for a Martin B-57 tactical bomber destined for large engines, presumably the Pratt & Whitney J57 planned for the B-57D model. Current production is at Wright-Patterson.

The forging was handled at the Martin shops on standard equipment, but ingenuity and imagination were needed in large quantities. Five major operations were done before heat-treating and six rough machining operations were done afterwards. Six production tools were used in the operations.

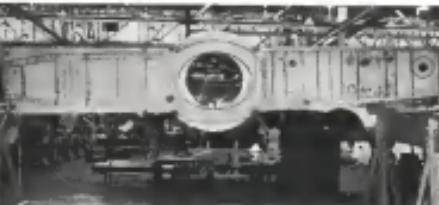
"Machine tools normally considered adequate for several aircraft work are too small for large forging work," said E. H. Park, supervisor of Martin's Detroit Process Planning Section. "We would be able to reduce the heating required for this job if machines were available to perform all the operations in one position."

Size of the finished part is 15 ft. 7 in. long by 46 in. wide and 6 in. thick. Park said that if temperatures had been higher, it would be economically feasible to call for a more refractory forging to reduce the number of annealing operations.

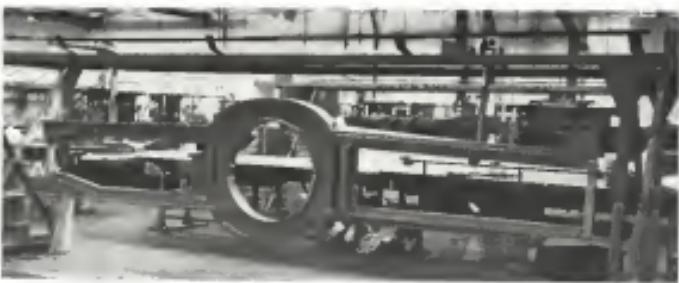
The forging is made on an 18,000-ton press by Bridgport Press Co., Adrian, Mich.



PLATING IS FIRST machining operation on the 2,500-lb. 75 S classifies forging for the wing spar of a modified Martin B-57 bomber. Excess material is removed in this step.



EARLY SPAR FITTING was heated in ability to take larger engines by diameter between upper and lower spar shanks. Forging was necessary for large and stronger structure.



HIGH FORGED SPAR FITTING contains with main model (above) in view of hole available to take large engine. Forging has been rough machined and smoothed at the stage, it is sent back to Bridgport Press for heat treatment and returned to Martin for final

SPECIAL AIRCRAFT PUMPS

Eastern Aircraft Pump Division has developed a new line of aircraft pumps. These are built to meet all applicable government specifications under various models. All types of Eastern pumps described are available in sizes ranging from the entire family of standard sizes, and provide a wide choice of performance.

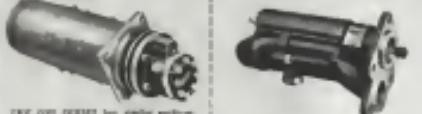
Special model pumps or completely new designs can be custom-made to your project.



TYPE 1000 SERIES is the simplest and lightest line of pumps ever made for aircraft use. It consists of a pump unit with a single stage of 1000 rpm. The operating pressure is high enough to be accommodated by most aircraft, yet low enough to be used in many applications for low head and high flow rates. They are particularly suitable for auxiliary operations, providing a reliable backup power source for emergency fuel delivery, emergency cooling or pump service on aircraft.



TYPE 1000 SERIES was designed as a pump for aircraft use. It is the first pump in the 1000 Series. The design of the pump is unique in that it is a single stage pump with a single stage of 1000 rpm. The pump has a maximum head of 1000 psi and a discharge rate of 1000 gpm. The pump is designed to withstand a temperature range of -40° F. to +100° F. The pump is capable of operating at speeds up to 1000 rpm and can be driven at speeds up to 1000 rpm.



TYPE 1000 SERIES has been produced in a variety of sizes and configurations to meet the requirements of the selected users in this group. It is available in different sizes and different materials.

LEADERS IN DESIGN-ASSISTED PUMPS

1000-10000 GPM

1000-10000 PSI

1000-10000 RPM

1000-10000 FPM

1000-10000 CPM

1000-10000 RPM

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Announcing...

FENWAL'S NEW JET ENGINE HARNESS AND INTERCHANGEABLE THERMOCOUPLES, PROVIDING

- Operation at temperatures over 1200°F
- Foolproof installation, simplest maintenance

A NEW CONCEPT IN TERMINALIZATION

Fenwal's new concept of **Burton Terminalization** for integrated assembly of thermocouples and harness allows a new level of installation. Only two bolts and four nuts are required to make electrical contact! It can easily be installed in 15 minutes by a mechanic who has never seen it before. All the thermocouples are offset, so they can only be installed in one way. And should a thermocouple go bad all you have to do is remove two bolts and insert another thermocouple. And that's a great advantage in maintenance.



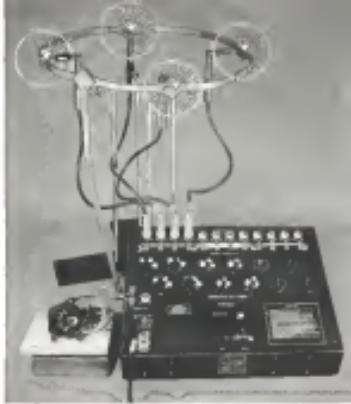
SOLID STAINLESS STEEL CASING PROTECTS WIRES

Even the wires on the Fenwal harness are covered in an insulated blanket and mounted in a stainless steel covering. This prevents the wire from becoming frayed and severed during installations or from vibration while in use.



DIFFERENTIAL EXPANSION NO PROBLEM

Fenwal's new Burton Terminalized harness is rigid, yet flexible enough so that differential expansion will not cause difficulties. It is so designed that even when bolted in place the harness is flexible enough so that no great stress is placed upon the thermocouple housing or mounting bracket for the harness. That means holding brackets do not have to be "bedded up" in order to withstand large forces due to differential expansion.



BALANCED RESISTANCE HARNESS

The resistance path from each thermocouple to the indicator is equal, minimizing unbalance (oscillating currents) and enabling maximum accuracy.



ENGINE TEMPERATURE INDICATION AND/OR CONTROL

WRITE FOR ALL THE FACTS

Fenwal's new concept of Burton Terminalized harnesses will be of great interest to you. Write for complete data now, to Fenwal Inc., Radiation Products Division, 157 Pleasant Street, Andover, Mass.

Fenwal's new **Burton Terminalized thermocouple and harness assembly** is ideal for indicating temperatures. It is also used for control because of the great reliability of the Fenwal thermocouple. In fact, Fenwal thermocouples and harnesses can be used on our new generation aircraft engines. They will withstand ambient temperatures over 1200°F.

Fenwal

Controls Temperature... Precisely

new **Bendix**
expanded range
OMNI-MAG



...combines 3 sources of VOR/ILS flight information on a single dial

These vital VOR/ILS instruments in one, that's the Bendix Omni-Mag Indicator. It performs all the functions of a Relative Magnetic Heading Indicator, a Flight Path Deviation Indicator, and an Course-Steering Selector... and combines the information from each on a single, easy-to-read dial.

With this 3-in-1 "picture" feature, the Bendix Omni-Mag has found wide acceptance

in the aviation industry. Twenty-nine airlines, more than 300 executive aircraft and hundreds of military aircraft are equipped with the Omni-Mag. Now, with the addition of an Expanded Range facility, the new MN-97H Omni-Mag takes its place as the lowest cost, most versatile, reliable and easiest to use VOR/ILS instrumentation system available.



...smooths out ILS approaches... eliminates need for bracketing

The Bendix Expanded Range Omni-Mag shows the pilot well in advance that he is approaching an ILS localizer beam. As a result, he can make a direct "close" on the beam, without the usual need for bracketing. By making possible more positive, quicker ILS approaches with considerably less maneuvering, the MN-97H promotes flight safety and helps reduce pilot fatigue.

For full details and specifications about this

new Bendix navigation instrument, write Bendix Radio, Aviation Electronic Products, Baltimore 4, Maryland. See 88-PA-98.

Bendix Radio

Bendix Radio Division • Bendix Aviation Corporation • Baltimore 4, Md.
West Coast Sales Office: 10000 Wilshire Blvd., West Hollywood, California
Aerospace International Division, 200 E. 42nd St., New York, N.Y. 10017
Cessna Distributor: Cessna-Radios, 8001 International Blvd., Houston, Tex.



Close Support Control

Tactical close support control art the MRG 1A, consisting of air transportable machinery, performing tasks, requires, and communications equipment, can be used to guide fighters, bombers to their targets. Systems will design and built for Air Force by Kevins Electronics Corp., subsidiary of Dynamics Corp. of America.

Burst rate is fully automatic line.

(One of the objectives of the WADC development program was to redesign major parts for mechanized manufacture in order to over a potential bottleneck in event of national emergency. Conventional tools have a high hand-labor content.)

Although military equipment design can still be far to the rear of the civilian side, Eason hopes to top the ratio IV, industrial electronics market. Turning to MILSPEC products is a major step forward, and thus a clearance and ESD can get its production rates up to several hundred thousand tubes monthly, it selected the ceramic tube as an alternative to glass with no premium glass tubes.

On request to engineers who are designing avionic equipment for use in nuclear-powered aircraft, McCollough says that limited tests to date indicate the ceramic tube can withstand a nuclear fire density of 10¹⁰ per sq. cm. for a number of hours without adverse effects.

Performance characteristics for the two ceramic tubes now in production, and the two soon to follow, are shown in the table, p. 72.

NEW AVIONIC PRODUCTS

Components & Devices

- Centrifugal blowers, available with 60 or 100 cfm, 115 volt single or three phase or 24 volt motor. Typical air delivery is 60 cu. ft./min. against 4 in. S.P., when driven by a five pole motor at 1,000 rpm. Company also offers magnetic bypass air clutch which will

AVIATION WEEK, July 5, 1968

CHR NEWS

Why Douglas has first silicone rubber canopy seal



by
Bill Spencer
Chairman, Head Rubber Co.

The Ceramicom Head Rubber Co. A lot of new design and production ideas went into the Navy Douglas AID Sky Hawk. Among them is the first silicone rubber inflatable canopy seal.

Douglas bought this inflatable canopy seal problem to us in the design stage. Requirements of conventional organic rubber seals was extremely high due to weathering, aging and ozone cracking, both in use and storage. Being carrier based, AID maintenance and storage storage had to be minimized. It was desirable to have a canopy seal with longer service and shelf life.

A silicone rubber inflatable canopy seal would answer this requirement. It would be immune to swelling, ozone cracking and weathering. Inflammation is not a factor with the low pressure of -45°F or +270°F, and would not get ready and stiff or limp up when the cockpit was opened after a hot day on deck.

Could a silicone rubber inflatable canopy seal be made? If it could, we wanted to be the first to try.

Douglas engineers were willing to take a chance on this new design. They gave us the order. We made and qualified samples, got rate production and then helped bring one new "first" on the AID.

Silicone rubber inflatable canopy seals are now proven out. As a result, other silicone rubber inflatable canopy seals are on order and in the design stage for the Century series, as well as new ones still in preliminary designs.

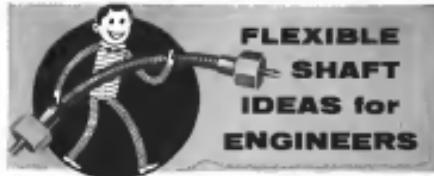
SEAL • INERTIAL

SILICONE RUBBER PRODUCTS

Joint Sealants • Canopy Fairings
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THE CERAMICOM HEAD RUBBER CO.

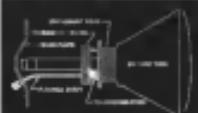
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Gain extra design freedom...create cost-saving opportunities with S.S.White flexible shafts

S. S. White "Metal Muscles"® are readily adaptable to a wide range of space, operating and service requirements

BY ERINNE G. S. WHITE FLEXIBLE SHAFTS
to transmit power or control between two parts, many of the transmission places on a chassis by rigid connections can be quickly removed.



A flexible shaft mechanism shown with notes:
A running current flexible shaft used in a Threading device.
you can use them to maximum advantage and will also have a wider selection of shaft sizes, styles and characteristics to choose from than if your design is "locked up."

Get informed.
Over 100 years, you can always count on S.S. White flexible shafts to increase your knowledge of your application. S.S. White's many designs and manufacturing developments have made S.S. White flexible shafts first in the field for quality, performance and dependability. Experience has shown that when it comes to flexible shafts you'll always be right—if you specify "S.S. WHITE".

A "must" for every design engineer

S.S. White's technical literature on flexible shafts, tells how to select and apply them best for your application.

**FIRST NAME
IN FLEXIBLE SHAFTS**

By far the best time to consider using S.S. White flexible shafts is when your product is still in the design stage. Then



will consider for control working. Amplifier is rated 1 watt at 70°C, can operate down to -55°C. Output stage consists of two germanium transistors, operating at about 47° per watt. Input plate current is about 11 x 10⁻³ amp. John Oscar Manufacturing Co., Allentown, Pa., 18101, U.S.A.

* Precision film plus motion are now available in glass mounted resistors. Type N is now available in one-watt size with resistance up to 400,000 ohms while two watt sizes are available with



up to one horsepower. Temperature coefficient has been reduced from 500 to 100 ppm/Deg C. The input rating is based on 10°C ambient and resistors have a life of 100C. Corning Glass Works, Corning, N.Y.

Laboratory & Test Equipment

* One megapixel signal source, reportedly able to output 1 part in 10¹² per day. Output is 4 x 1 mm or 1 x 1 mm. Application bulletin available. Duron Electronics Inc., 73 Cambridge Pkwy., Cambridge, MA, 02142.

* Vibration testing machine, Model 14-25, can handle 3 lb. resonant load,



exerted at frequencies of 10 to 35 cps over total excitation up to 0.05 in. on infinitely variable instruments. Unit operates from 115 volt, 60 cps. The Acoustek Instrument Co., College Park, Md.

* Power transistor test set, Model KPI-1 includes all hybrid parameters in either grounded base or grounded emitter configurations over frequency range of



100 cps to 200 kc. Instrument permits reversal of carrier mount, collector voltage or both to observe effects of recharacterization. Baird Associates, Inc., 13 University Road, Cambridge, Mass.

New Avionic Bulletins

* Precision resistors and resistor networks for MIL-STD-202G, MIL-STD-214 and MIL-STD-205. Resistors include 211 above spec and some below the general specification. Resistors are available in 100 parts/1000 hrs., New York, N.Y.

* Electronic waveguide attenuators are made to MIL-STD-202G, MIL-STD-214 and MIL-STD-205. They are available from Comac Electronics Co., 1700 Brookhaven Ave., Clifton, NJ, 07011.

* Electronic waveguide attenuators for electronic waveguide equipment. Type NM-004 for use in 20-25 to 15-30 microns. Of polyimide material. Available in 100 parts/1000 hrs. Bristol, Rhode Island.

* Enclosed ultrasonic repeaters capable of 100% reliability. Units are manufactured according to MIL-STD-202G, MIL-STD-214 and MIL-STD-205. Manufactured by Photonic Industries Inc., 200-401 N.W. Broad St., Philadelphia, PA, 19103.

* Electronic waveguide isolators for electronic waveguide equipment. Type NM-004 for use in 20-25 to 15-30 microns. Of polyimide material. Available in 100 parts/1000 hrs. Bristol, Rhode Island.

* Enclosed ultrasonic repeaters and ultrasonic isolators for electronic waveguide equipment. Units are manufactured according to MIL-STD-202G, MIL-STD-214 and MIL-STD-205. Manufactured by Photonic Industries Inc., 200-401 N.W. Broad St., Philadelphia, PA, 19103.



1 Resinite EP-69A VINYL INSULATION SLEEVING

SLEEVING FOR GENERAL PURPOSE and for MIL-I-631C

This one multi-purpose sleeveing is the perfect answer for a wide range of applications. Not only is Resinite EP-69A ideal for MIL-I-631C (Grade n-general purpose and Grade b-low temperature) requirements, its low price makes it also practical for non-spec general purpose use. Using this one material for many different jobs simplifies ordering and reduces your stocking inventory.

Resinite EP-69A exceeds MIL-I-631C Type F, Form U, Class I and II, Category 1 and 2 in both Grades n and b. It provides a working temperature range from -65°C to +60°C and a dielectric strength of 750 volts/inch. It is corrosion, fungus, oil and flame resistant. Available in all standard sizes and in colors. Special colors to order.

SOFT WOUND SPOOLS assure FULL ROUND SLEEVING

Let Resinite EP-69A satisfy your vinyl sleeving requirements.

Write for samples and performance data now.



S. S. WHITE INDUSTRIAL DIVISION, DEPT. V, 10 EAST 40TH ST., NEW YORK 16, N.Y.
Western Office: 10338 West Pico Blvd., Los Angeles 5, Calif.

BUSINESS FLYING

Private Deliveries Reach New High

U.S. business and utility aircraft manufacturers continued breaking their records of recently annual deliveries by shipping a net total of 693 units in May at a net billing value of \$18,616,072. This represents an increase of 10 aircraft over the previous high of April.

The May figures bring the totals thus far this year to 3,289 aircrafts indicating that the present rate of aircraft deliveries will exceed the total number last year's total of approximately 4,100 units. Reports from the field show no slackening of manufacturers' desire for new business airplane production.

ing record continued high production levels throughout the year, and an instant impact on a high demand for supplies items including powerplants, propeller, radar and navigation equipment and a host of other products.

Production by the major manufacturers under this rate can also be expected to remain record-breaking because so good margins seem to be available to the aircraft industry compared with the auto and aircraft industries.

* **Aero Design & Engineering Corp.** delivered 45 airplanes valued at \$3,637,500 through May, this year compared with 54 units valued at \$3,321,-

000 in the same period last year.

- **Bechtel** delivered 375 units through May valued at \$12,548,566 or approx 30% higher at \$10,916,000.
- **Cessna** shipped 1,594 units valued at \$16,412,341 compared with 747 aircraft valued at \$8,421,000.
- **Piper** delivered 1,074 aircraft valued at \$10,472,887 or approx 37% units valued at \$7,381,000.

An important source of higher revenue for manufacturers are the increased output of business-class business aircraft. In fact, the facturing through May of these 481 were built in four manufacturers: Aero Design, Bechtel, Cessna and Piper. Last year through May these business shipped 120 units. During those years valued at \$1,052,276 were reported by U.S. business plane builders in May, an increase of 37% over the average number of units shipped monthly last year and a 50% increase over 1955.

The May shipments brought the total since January 1956 to 574 aircrafts valued at \$16,305,461. Manufacturers reported a total of 400 planes valued at \$17,493,521 in all of 1955.

Planes delivered abroad went to 21 countries, with Canada taking the largest number, 25 units valued at \$1,511,423. Hawaii and Alaska took an additional 11 planes valued at \$113,158.

The breakdown by destination: Argentina, 2; Argentina, 1; Belgium, 1; Canada, 25; Chile, 1; Colombia, 2; Costa Rica, 2; Cuba, 1; Ecuador, 1; El Salvador, 1; Iraq, 1; Madagascar, 1; Mexico, 1; Morocco, 1; New Zealand, 1; Paraguay, 1; Peru, 1; Saudi Arabia, 2; Switzerland, 2; Union of South Africa, 3; Uruguay, 1; and Venezuela, 3.

ROTC Program Would Cut Washouts, NATA

Current cadet pilot淘汰率 of 41% could be reduced to 30% if less flight training was emphasized in current college ROTC programs, a spokesman for National Aviation Training Association testified before a subcommittee of the Senate Armed Services Committee.

Edwin L. Lewis, vice president training for NATA, which represents fixed-wing operators offering pilot training in 45 states, advocated Senate passage of the House-passed Bill H.R. 3715. Under the program, U.S. Air Force would contract with local fixed-wing operators to supply about 35 to 45 flight hours in light aircraft to ROTC college students. Lewis reviewed USAF studies that

Shipments by Plants Manufacturing Complete Civilian Aircraft and Engines for Civilian Aircraft		April 1956	January-June except Following Month and April	Cumulative totals January-April
Complete aircraft, total airframe weight (thousands of pounds)		1,210.8	1,229.3	3,693.3
By weight of plane				
Under 3,000 pounds airframe weight	436.8	600.1	2,290.5	1,382.8
1,000 pounds airframe weight and over	588.7	629.4	3,281.4	2,113.2
By number of planes				
1- and 2-place	515.3	548.8	1,820.8	1,248.1
3- to 5-places	644.3	685.7	1,399.8	9,212.4
Over 5-places				
By total rated horsepower, all engines				
Under 100 hp	544.8	510.6	1,946.0	1,880.8
100-299 hp	675.9	717.7	1,727.6	2,152.9
400 hp and over				
Aircraft engines, number	98	97	3,800	3,859
Aircraft engines, total horsepower (thousands of horsepower)	426.4	481.5	1,647.7	1,233.9

		1956	April 1956*	Cumulative totals January-April	
		April	March*	1956*	1955*
Complete aircraft, number		892	856	413	1,649
By weight of plane					
Under 3,000 pounds airframe weight	881	823	682	3,188.5	1,235.1
3,000 pounds airframe weight and over	31	33	13	193	89
By number of planes					
1- and 2-places	827	802	413	2,204	1,48
3- to 5-places	59	54	36	199	153
Over 5-places					
By total rated horsepower, all engines					
Under 100 hp	617	581	480	1,220	1,435
100-299 hp	75	75	53	579	584
400 hp and over					
Value of shipments of complete aircraft and parts, total (thousands of dollars)	40,648	40,113	88,167	152,999	156,665
Aircraft, total					
Under 3,000 pounds airframe weight	30,219	28,568	55,799	113,793	94,939
3,000 pounds airframe weight and over	8,526	8,594	6,193	36,677	39,758
Aircraft parts					
Under 3,000 pounds airframe weight	9,323	10,484	11,484	31,188	36,183
3,000 pounds airframe weight and over					
Value of shipments of aircraft engines and parts, total (thousands of dollars)	19,906	19,657	11,346	35,644	46,774
Aircraft engines					
Gasoline engines	7,857	7,620	5,146	19,092	21,549
Gasoline parts	11,959	11,537	6,278	45,354	55,175
Utility vehicles (number of planes 3,000 pounds airframe weight and over)	867	841	335		

* Revised.

affected the effectiveness of light-plane expenses on aviation pilot training costing a maximum of 25,210 dollars.

Edmund Lewis, vice president training for NATA, which represents fixed-wing operators offering pilot training in 45 states, advocated Senate passage of the House-passed Bill H.R. 3715. Under the program, U.S. Air Force would contract with local fixed-wing operators to supply about 35 to 45 flight hours in light aircraft to ROTC college students.

PRIVATE LINES

Experimental television programs aimed at developing public interest in flying are being given a network trial in the form of Annual "Flight and Fun" television programs of 15 minutes each for children who had not taken 20% flight time, those whose previous flight experience had been only as a passenger, 37%, and those who had not previously flown, 39%.

French-British Anglo transatlantic flights, first started eight years ago, now involve 170,000 SNECA passengers. The Anglo routes fly, including a pilot, on single flights of 1,000 miles.

Air Commodore Jameson, covering northern Ohio and greater Cleveland, has Aviation Inc., Akron, Ohio.

An 18-to-19-year-old speed record is reported for James & Langley Steel Corp.'s Lockheed Lodestar following modification by Pacific Aerospace

* Model 176 production discontinued because of overwhelming demand for Model 178, which is similar but has a larger landing gear.

Includes sales of three factory-repaired Cessna 195s and two experimental versions of L-19.

Sources: Compiled by AVIATION WEEK. Primary statistics for 1956: AW May 18, p. 921; AW May 1, p. 325; Apr. 2, p. 67; May 19, p. 63.



This is the Honeywell capacitance fuel gage.
Completely transistorized, it's smaller,
more reliable, and as light as 0.8 pound per
system. And like Honeywell's pioneer electron-
tube gage, it's so accurate it measures any
fuel load to within two percent. Honeywell,
specialists in gaging of all types, has
fuel measurement systems specified for more
than 120 different models of aircraft.

AERONAUTICAL DIVISION, MINNEAPOLIS-HONEYWELL



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Honeywell

Aeronautical Division



Poles Show the West New Aircraft

Western reaches to the recent 15th International Paris Fair in Poland were shown several new training aircraft including an Alouette tandem trainer (left) and the North American T-38, and several gliders. Large-scale racing by youths brought the bi-

Cop., Barbak, Calif. (AW June 18 p. 311)

Fast expansion of service outside of its Dallas, Tex., base has been established in Southwest Aeromarine Co., which set up distributional offices in Kansas City, Kans., and Denver, Colo.

Bonell Aviation Helicopter will be used in aerial geological survey operations in Konigsberg, West Germany. One Bonell helicopter will be fitted with an electro-magnetic suspended in a cable.

Large business aircraft service center has been opened at Postman Park's Airport by Robert W. Fiedler, of Toledo, Ohio. Non-schedule will handle planes to Connor Field and provide 24-hour service, maintenance and cargo facilities. Firm is building a fleet and antenna hangar with capacity in 40 tons each for business. Robert W. Fiedler has bases at St. Louis and the new Express Airport, Toledo, Ohio.

Sears, D. distributor aviation oil, in Grades SAF 30, 40 and 50, is being marketed to business plane operators in Gulf Oil Corp. Product has an anti-freeze agent.

Lear has increased the speed of the Learjet 34 another 15 mph, by new modifications, making the top speed 599 mph. Changes include shortening the oil cooler, adding new cylinder baffles to reduce back pressure and new propeller spans.

Biggest aerial attack by Department

of Agriculture on insect infestations will cover 2.6 million acres in New Eng. land and the Mid-West in a two-month period. More than 20,000 tons of insecticides will be sprayed over the area against gypsy moths. Mission consists of cropduster Cessna agricultural aviation specialist. Gale



In Moscow

Aerospace equipment manufacturer William P. Lear and wife, Myra, stand by their private plane after arrival at Vnukovo Airport in Moscow June 25. Lear and his wife, plus a Russian engineer, flew from Berlin with a refueling stop at Vilnius, Lithuania. The airline, Western, legally is a personal plane and Myra was then the same title in Air Force Chief of Staff Norton Twining and parts. Photo carried a lead of Lear products for inspection by Soviet officials.

Benson will work with safety agents in these areas to check pilot qualifications, techniques and maintenance of the 75 planes which will participate.

Swissair-Revenue Increases in 1955

Swissair has a total of 61,994,149 revenue kilometers during 1955, showing a net profit of \$577,793 for the year according to the airline's annual report. Swissair carried 650,793 passengers over 9 million ton-kilometers of cargo.

Average passenger load factor was up to 84.8% from 80% in 1954. The

1955 cargo total represented an increase of 45% over the previous year. North Atlantic traffic accounted for about a third of Swissair's total ton-kilometers flown during 1955.

USAF Tests Beech's Model 73 Jet Trainer

USAF started a test program on the Beechcraft Model 73 jet aircraft last week to determine its suitability for a medium test aircraft jet trainer.

Federal Av. Test Board flight test personnel will spend two weeks at Beechcraft's Wichita plant to study the plane's present flight characteristics and landing qualities.

WHO'S WHERE

(Continued from page 23)

Dr. George A. Heller, general manager Defense Electronics Division, General Elec. Co., Somers, N. Y.; L. Barker Davis, general manager, G. E. Electronics Com. products Division, Divisions, Inc.

Robert W. Lee, director, Marine Locomotive Division, General Precision Industries, Rochester, N. Y.; Vice Donald S. Kelling, chief engineer, W. H. Heath, executive chief engineer Dr. George E. Gossenstibbles, research director, Otto J. Kolk, chief product engineer and Donald S. Rausch, chief project engineer.

Henry Schlesinger, chief engineer, Tele. switcher Division, Inc., Webster, N. Y.; Clarence E. Lake, traffic and sales manager, Telequip, Inc., Scranton.

Dr. Selmer L. Strickland, director of applied research Research & Development Division, Allis-Chalmers Corp., Milwaukee; C. A. B. Custer, director of research, Allis-Chalmers Vickers, Inc., Detroit, Mich.

A. L. Pappert, sales manager, aircraft equipment dept., Westinghouse Electric Corp., South Motor Division, Louisburg, Okla.; William W. Chapman, sales manager, American Products Division, Batavia, N.Y.; Mike Vassallo, Inc., New York.

Ernest E. Parker, defense products manager (Dayton), American Machine & Foundry Co., New York, N. Y.

Glen A. Evans, general manager, Marine Division, Windham-Singer Corp., Marion, Ohio.

Al Cook, chief pilot, Commando Air Service, Inc., Somers, Calif.

David DeVoski, general supervisor of electronic maintenance, Boeing, Everett; Vernon S. Sorenson, chief pilot, captain, U. S. Postal Service, Inc., Seattle, Wash.; Edward V. Ahern, chief pilot, captain, special air transport, Defense Information Sales Dept., General Electric Co., San Diego, Calif.

Stan E. Erbeck, project manager, aircraft division, Northrop Aircraft, Inc., Hawthorne, Calif.

W. L. Caselli, manager, General Electric Co.'s electron tube plant, Ansboro, Va.; Marvin D. Wiles, manager, Applied Devices section department, Fisher & Paykel Co., Hibbing, Minn.

Philip A. Alton, Jr., manager, Aerostatic division, Project Corp., Van Nuys, Calif.

Kenneth E. French and William H. Knott, Jr., senior sales managers, Republic Aviation Corp., Cleveland, Ohio.

Harry E. Gwin, chief engineer, Semiconductor Components Division, Texas Instruments, Inc., Dallas, Tex.; Tom Lavelle, chief engineer, Reed Corporation, research director, plastics; Charles F. Hartnett, contract projects, John E. Bell system and team leader, Lawrence Livermore atomic energy commission; James E. Johnson, director, communications engineering; Robert W. Brown, manager, marketing.

Joseph A. Mathews, manager, Functions division, Defense Communications, Melville Park, Ill.



Whittaker Gyro

DIVISION OF TELEMECHANICS CORPORATION
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Boeing's new Mach 4 tunnel: a vital step in the engineering art

In addition to the new tunnel, Boeing also is building advanced facilities at Boeing, the latest electronic computers, a chamber that can simulate altitude up to 100,000 feet, a servo radius reflector at the Flight Test Center, and more than 2,000 sq. yards of insulation of Boeing's standard grade. The computer can complete more than 100,000 operations during the peak of World War II—and more, engineers say.

Boeing and its engineers will be able to test new structural configurations and materials under the extreme conditions of transonic flight. Theoretical analysis will develop new techniques in instrumentation, and by our own ideas in modern configuration design and more other fields. Advanced wing tests will be able to study the behavior of smooth and spindled missiles in high speed flight.

In addition to the new tunnel, Boeing also is building advanced facilities at Boeing, the latest electronic computers, a chamber that can simulate altitude up to 100,000 feet, a servo radius reflector at the Flight Test Center, and more than 2,000 sq. yards of insulation of Boeing's standard grade. The computer can complete more than 100,000 operations during the peak of World War II—and more, engineers say.

Engines in combat by Boeing will lead the way in the art of transonic flight. They will find individual recognition and opportunity for advancement at small, highly concentrated teams whose design of jet aircraft. And their and their families will enjoy living in the pleasure and pride of community of Seattle and Wichita. There may be a place for you in this

challenging world of tomorrow at Boeing, Seattle or Wichita. Write us now, and find out who's?

JOHN C. SANDERS, Staff Engineer — Personnel
Boeing Airplane Co., Dept. C-33, Seattle, Wash.

E. J. BRITTMAR, Advance Test Engineer
Boeing Airplane Co., Dept. C-36, Wichita, Kansas

If you want further information on the above items or if you are living outside and would like to receive any of the above addresses:

Name	Address	Telephone number
John C. Sanders	Boeing Airplane Co., Dept. C-33, Seattle, Wash.	
E. J. Brittmar	Boeing Airplane Co., Dept. C-36, Wichita, Kansas	
Seattle	Seattle, Washington	Seattle, Washington

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NEW AVIATION PRODUCTS

Lightweight Refrigerator

A new, lightweight aircraft refrigerator is giving airplane manufacturers Collett Aircraft Industries, Inc., the unit can draw from 3000 to 2100 ft. above sea level. A travel weight of 7 cu. ft. and a load weight of 157 lb. and draws 8 amps at 25 v. Being purchased are Northwest Coast Airlines, Trans World Airlines, Canadian Pacific Airlines, Lockheed Aircraft Corp. and Comair.

Nordisk Co., Inc., 16000 Stratford St., Van Nuys, Calif.



takes about six hours to clear the pressure regulator control head, the filter can be cleaned at intervals.

The assembly consists of an Allis carburetor design housing unit, an NBSA cartridge-type filter element, poppet valve and float.

Mine Safety Appliances Co., Pittsburgh 19, Pa.



Bellows Tie-Rod Assemblies

Two types of stainless steel bellows tie-rod assemblies for use in jet engine pressure ducting systems are available in diameters from one-inch to 15-in. The centre link or single-point type connects the ends of a bellows at a single point along the bellows center line. The double-point or double-link type has two points on the bellows center line to reduce the tendency of shorting and binding effects.

Metal Products Manufacturing Division, Amsted Rubber Co., Long Beach, Calif.



Surface Polisher for Missiles

Unidirectional step function on any of the control surfaces of a test missile are exposed by a surface polisher using 30-22 cu. in. black carbide tips which alternately cut a pair of opposed cavities. Positive contact pressure into rotary motion through linkage.

Amplitude, duration and time spacing of the square wave pulses are controlled by a logic circuit consisting of 200 1N3055 transistors, using 22 short black blocks. Higher values are available with 22 long or long side blocks. Useful overall length is 17.5 in. x 31 in.

Hansen-Cord-Brown, Inc., 55 Hazel St., Glen Cove, N.Y.



Tubeless Power Source

Dual-wattage electrical service power source provides instant-service for volt d.c. for missile and aircraft instrumentation. The unit is designed to operate up to 60,000 ft. high altitude efficiency. This is accomplished through use of a 2146-33 Connector which permits the MRB-515 to stay 11 v. a.s.t. at full altitude.

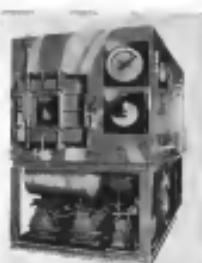
Algebraic key oscillator circuitry makes low voltage requirements from the output and regulates d.c. to 10.1% accuracy, the maker reports. The equipment is said to be short-circuit proof, has no tubes and requires no batteries or fusing. It thermally sealed in thermosetting plastic and meets MIL-T-77 and MIL-E 5127A. Silicon diodes provide stable operation at 100°C.

Magnavox Research Corp., El Segundo, Calif.

Fitter for Cabin Pressure Units

A new cartridge fitter for AiResearch cabin pressure regulating equipment has been developed at AiResearch's research and development laboratory to facilitate the regulation. The manufacturer of the regulating equipment normally recommends a change of filters after every 1,000 flying hours.

Sherline Divisive is also reported when using the new filter, steadily it



Test Chamber Simulates 150,000 Ft.

Designed specifically to a request by Canadian Werkgroepen engineers for a large environmental equipment 100-chamber capable of simulating 150,000-ft. altitude, this unit features automatic temperature control from -100°F to +100°F and humidity can be controlled from 0 to 95%.

Wickel Manufacturing Co., Inc., 2740 Madison Ave., Indianapolis, Ind.

Flight Control Servo Valve

A stabilization and flight control servo valve first uses dry air in construction but an isolator diaphragm that

specify LEWIS
high temperature and
moisture resistant
aircraft electrical cable
for critical circuits.

to MIL-C-25038



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The Ramo-Wooldridge Corporation develops scientific and aerospace electronic instruments and components to broaden the earlier products open in the Instrumentation Department.



functions as a positive fluid barrier. Coil and all magnetic circuitry operate in air rather than fluid media, preventing contamination by buildup of iron oxide particles. Two internal magnetic corrosion-resistant steel filters are used to handle oil flows through the valve. All oil that passes through the hydraulic amplifier section must go through these separate filtering stages.

Hobart Research & Manufacturing Co., subsection of Bell Aircraft Corp., 2015 N. Nasau St., Buffalo, Calif.



powering of cockpit instrumentation in multi-engine aircraft or supplying controlled-frequency ac power to each generator.

Speed control is within +7% regardless of load. Special configurations will maintain 400 rpm frequency within ±0.1% regardless of load. Units are currently available in sets for 0.5 to 1.5 kw output. Weight ranges from three to 19 lb.

Vickus, Inc., Box 382, Detroit 32, Mich.



Airborne Fan Blower

This blower unit for airborne applications is designed for the most difficult to maintain blower speeds. Unit provides 210 cfm at two inches back pressure at 3,000 ft. at 60,000 ft., blower speed goes to 11,000 rpm.

Vibration has been reduced. The one with horsepower as motor operates at 115 v, 25 rpm, 400 cycles. Designated Model BC 2814 F1, the blower is also available with a dc motor.

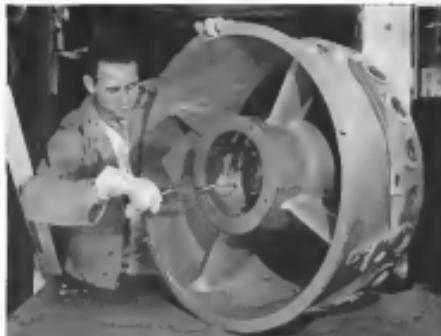
Induction Motor Corp., 570 Main St., Webster, N. Y.

Electric Power Packs

A line of hydraulic-powered electrical power packages for aircraft consists of a 400-cycle ac generator driven directly by a high-speed, constant-speed oil-hydraulic motor. The motor is powered by flow available in the aircraft's existing hydraulic system. Applications for the units includes

Applications for the units includes

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At the transmitter you want to have an antenna or center frequency which can be accommodated in the new 27 channel Narco Simplexer. This frequency can now be selected from 110 to 136 MHz and transvert—selected by a separate switch mounting circuit—the simplexer gives you the choice of either a "transistor" or "vacuum-tube" tuning feature which lets you tune the VHF receiver exactly to the desired frequency.

The simplexer accommodates all 24 frequencies used between 108.1 and 136.0 MHz. It has a built-in additional crystal to expand coverage.

Its other accommodations and availability make the Narco Simplexer unique and matching your requirements for anywhere near the world. Your communications needs are important to us. Call or write our new KCIK Electronics Dept. at 1000 Park Street, Dallas, Texas, or write our new distributor:

Simplex Adds GMNS

for only \$195

Here's the answer for a low cost, no-expense-Gone—The Narco GMNS. It's plug-and-go, any Narco Receiver. Only 2" high and 4" wide, it has variable tuning for precise control. It's a real time-saver. Order today and you'll know exactly how dual audio can help you.

narco
NATIONAL AUTOMATICAL CO. OF AMERICA, INC.

verage ground power carts, surface mobile power units and laboratory equipment are also possible. Unit was developed at the request of Baatz Jack & Hoata Inc., 17600 Remondin, Cleveland 1, Ohio.

ALSO ON THE MARKET

Permanent magnet motors, Type BYLM have a centrifugal blower for dissipating heat generated by electronic tubes, circuit components and similar equipment in confined enclosures. Units are available with dualities as counter-clockwise rotation or several speeds. Barber-Colman Co., Aircraft Controls Division, 1000 Rock St., Rockford, IL

Measuring Teflon coaxial cables, Types K-256, K-357, K-358, for plane and missile application are one-quarter wave lengths of comparable RG-type, set provide same impediment characteristics. Impedance ranges are 50, 70 and 93 ohms. They can operate in 180°C environment. Manufacturer can also supply Type SP 152 four-core cables for missile motor and electronic controls. Cable has a minimum outside diameter of 0.275 in.—Federal Telephone & Radio Co., Division of International Telephone & Telegraph Corp., 100 Ringling Rd., Carbon N.Y.

Sel-lock, splice type nut for use with aluminum and magnesium alloys is designed for blind mounting. Use for three 4 cross-threaded holes. Type ND-2700 meets AN-VS-5 or MIL-N-5427 (ASG) requirements. Available in thread sizes 10-32, 4-28, 4-28, 10-32 and 12-20—Elevate Step Nut Corporation of America, Union, N.J.

Flexible lead wire, made of aluminized AISI 317 stainless steel, is designed for use at up to 1,100°F. Designated 110B W, external diameter 12-pair design is for application in jet engine combustor, afterburner and nozzle hot area. Available in standard wires from No. 10 through 1/4 diameter—Stand and Frost Steel Co., Jenkintown, Pa.

Self-contained storage oscilloscope, with infinite reference persistence, permits all stored waveforms at equal and constant brightness until interaction with crossed fields. Model 102 Mississippi was electronically improved to a complete flying focus and free of all high voltage spikes—Advanced Electronic Laboratories, Manufacturing Co., 2029 Park Ave., Los Angeles 25, Calif.

Tankless for living aircraft fuel tanks, has also been found useful as a leak preventive. Fibers are applied hot in cellulose eliminating toxic solvents and

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More light planes are equipped with Sensenich Propellers than any other make.

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3-TOOLS-IN-1 pliers—twist-wire—heat-cutting, all-titanium lead. Permanent tensioning device. Adjustable jaws. Jaw back on wire, never slip off. Perfect, uniform twist every time.

12" for aircraft use \$21.50
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Delivery 4 weeks. Write for catalog. RALPH C. RONNING CO.
Box 4100W No. 2000 Main St., Calif.

Camden, Del. 19930/Orchard, Calif., 94552/

AVIATION WEEK, July 9, 1964

for travel during application. Industrial Products Division, H. B. Dutton Co., Rock & Stone Sts., Indianapolis 30, Ind.

Quick-dump flow control valve for use in original equipment as well as applications requiring manual or automatic taking off or water or fire. Seven models are available: solenoid, cam operated, palm button, finger tip, foot operated and hand lever type—Hydroline Products, subsidiary of General Car Light Co., Kalamazoo, Mich.

Microjet type 150 automatic gunite control, provides continuous direction towards dense grouting and uses automation to control final use of materials. Unit can be installed as either wet or dry coating grouting, it is for dense grouting piping or concrete pool deck with three-point grouting control and single-directional mounting for piping grouting—Industrial Products Dept., Air Horizons Instruments Laboratory, 161 Old Country Rd., Melville, N.Y.

Model 5500 fractional horsepower induction motor, direct driving unit, features an open, self-ventilated frame for cool operation. It is available for pad mounting, resilient ring mounting or end mounting. Shawind Industries, Inc., 1760 State St., Racine, Wis.

Strip burner, for hot forming titanium sheet and plate, is built in an length and shape. Other features are cold spots at ends of fixture, water cooler, faced with 20 gauge and natural or finished gun barrel steel, insulating ad plastic—W. C. Chiles Manufacturing Co., P.O. Box 3991, Seattle 24, Wash.

WHAT'S NEW

Telling the Market

Comminications, propellers and aircraft grade of aluminum—Grade 5052, 5056, 5056-H112, 5056-H32, 5056-H34, 5056-H36, 5056-H38, 5056-H39, 5056-H40, 5056-H41, 5056-H42, 5056-H43, 5056-H44, 5056-H45, 5056-H46, 5056-H47, 5056-H48, 5056-H49, 5056-H50, 5056-H51, 5056-H52, 5056-H53, 5056-H54, 5056-H55, 5056-H56, 5056-H57, 5056-H58, 5056-H59, 5056-H60, 5056-H61, 5056-H62, 5056-H63, 5056-H64, 5056-H65, 5056-H66, 5056-H67, 5056-H68, 5056-H69, 5056-H70, 5056-H71, 5056-H72, 5056-H73, 5056-H74, 5056-H75, 5056-H76, 5056-H77, 5056-H78, 5056-H79, 5056-H80, 5056-H81, 5056-H82, 5056-H83, 5056-H84, 5056-H85, 5056-H86, 5056-H87, 5056-H88, 5056-H89, 5056-H90, 5056-H91, 5056-H92, 5056-H93, 5056-H94, 5056-H95, 5056-H96, 5056-H97, 5056-H98, 5056-H99, 5056-H100, 5056-H101, 5056-H102, 5056-H103, 5056-H104, 5056-H105, 5056-H106, 5056-H107, 5056-H108, 5056-H109, 5056-H110, 5056-H111, 5056-H112, 5056-H113, 5056-H114, 5056-H115, 5056-H116, 5056-H117, 5056-H118, 5056-H119, 5056-H120, 5056-H121, 5056-H122, 5056-H123, 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General principles of impact tools and methods of use, manual (second edition), P. A. Sharpen et al., Addison Ill. Illustrations, discussions, methods of fabrication and applications of shock and vibration insulation. Industrial Bulletin #1081, Robinson Aviation, Inc., Timonium, Md. Principles of operation and available head styles, dimensions and lengths of 700' rivets, bulletin RL-112, Fairchild Corp., Chevy Chase Division, P.O. Box 21762, Bethesda, Md.

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* Positive Shot Peening of Propellers, Part I—Residual Peening Stress—by R. E. Bradish, Lantz, and Associates, Inc., for Wright Air Development Center, U.S. Air Force, 55-20, 438 pg. (Order PB 111682 from DTIC, U.S. Department of Commerce, Washington 25)

Illustration of the benefits of shot peening as a means of protecting steel-pipe bodies against the reduction of bridge strength during heat surface damage.

* Emergency Escape Procedures—by J. G. King, R. Gribble, and M. C. Richardson, Air Force Cambridge Research Center, 52-38-95 pg. (Order PB 121185 from DTIC, U.S. Department of Defense, Washington 25)



IN 1945: This large building height finder was designed and developed by General Electric to be used with powerful search radar systems and is a major contribution to long-range aircraft location.

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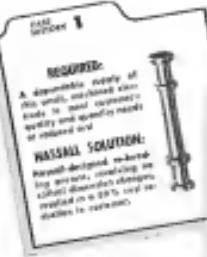
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ment of Commerce, Washington 25.) Knowledge gained from joint studies conducted by the Military Air Transport Service, U. S. Air Force and the Civil Aerospace Administration on escape of personnel from aircraft following simulated landing emergencies is brought together in this manual. The seven section manual material on crew training for this type of emergency, recommended procedures, cargo and device loading, and as a guide to emergency exit procedures.

• **Superseded Safety Manual.**—Written by staff engineers of the National Safety Council, 425 North Michigan Ave., Chicago 11, Ill. Price to Commercial users \$3.25, price to nonmembers, double; other prices if ordered in quantity 33¢ pp.

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• **Address Booklet at the Sixth National Conference on Standards.**—Available from the American Standards Association, 70 East 45th Street, New York 17, N. Y. \$1.00, 94 pp., 8 photographs.

Thirty addresses given at the Sixth National Conference on Standards, Washington, D. C., in October, 1955, on the general topic of the effectiveness of standards in solving safety and increasing efficiency. Speakers include Assistant Secretary of Defense Thomas F. Pyle and the vigilante engine industry, C. E. Moses.

• **Proceedings of the Gas Dynamics Symposium on the theme Aerothermodynamics—Heat at the Technological Institute, Northwestern University, Evanston, Ill., August 1955.** \$4.00, Approx. 250 pp. bound.

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• **Atomic Energy—Pub. in the Academy of Sciences of the USSR.**—Translated by Associated Technical Services, P. O. Box 271, East Orange, N. J. Six issues per year, available on annual subscription at the rate of \$85.00. Subscriptions and inquiries should be forwarded directly to A. S. L.

This Soviet journal will publish articles and reviews of latest achievements related to peaceful uses of atomic energy.

SAFETY

CAB Accident Investigation Report:

Eastern Flight Crashes Off Runway End

An Eastern Air Lines Martin 4-142, Flight 175, was damaged extensively when it overran the Tri-State, Yugor, Hangar, W. Va., at approximately 1650* on Jan. 13, 1956. No injuries resulted to either crew or passengers, and no fire occurred.

Flight 175 originated at Chicago, Ill., for Cleveland, N. C., en route over stops including Louisville, Ky., and Huntington. Captain Robert C. Moore, Pilot James L. Lewis, and Flight Attendant Delores D. Ford comprised the crew. The flight was en route to Cincinnati for return to Charlotte or alternate to Pittsburgh.

At Louisville the aircraft was delayed and at the time of departure carried 650 gallons of fuel and 12 passengers for a gross weight of 42,000 pounds. (Navy Capt. Charles C. H. Clegg was en route for the center of gravity test within commercial limits.)

The crew was given the latest Huntington, Charleston, and Cincinnati weather and the flight departed Louisville to ascend at 1730 on a VFR flight plan returning 75 minutes to Huntington.

Clouds were 4000 feet above and below the route. Enroute Huntington, Captain Moore cleared the flight approach and issued VFR clearance to N-4 Avenue to cross at 5000 feet, and then gave the latest Huntington weather. This indicated the ceiling to be 1000 feet visibility 1 mile with some light rain, and that breaking clouds were "poor" on the north-easterly route.

Charleston approach control closed the flight plan to approach to Tri-State Airport at Huntington. The aircraft crossed the end of the runway at 12,000 ft at an estimated speed of 90-95 knots, at an altitude of 10,000 feet and passed over about normal the length

of 4,000-foot runway before landing down. The crew was not able to stop within the confines of the airport and the aircraft went slowly over the bank of a slope approximately 100 feet beyond the end of the runway.

INVESTIGATION

The dispute adverse for the flight set off by Louisville later reported as charlie for Huntington and Charleston as alberta for Charleston. The run was changed at 1733 leaving Louisville as charlie for Charleston and returning Charleston as alberta for Huntington.

The Huntington, Charleston, and Cincinnati weather further prior to the time was as follows:

Huntington—Visibility ceiling

5000 obscuration visibility 6 miles, light

rain shower, winds, temperature 26, dew point 26, wind 20 mph. Charleston—Visibility

ceiling 6000 obscuration visibility

3 miles, winds 10 mph, 30° descent

30° wind, visibility 5. Cincinnati—

visibility 6000 obscuration visibility

3 miles, winds 10 mph, 30° descent

30° wind, visibility 5. Temperature

46°, dew point 24, relative humidity 100% over the 1000 feet. The winds then increased to 30° passed directly over the

airport and to angle measure it about 30°.

The flight reported as being over the Lexington VDR station at 1813 at 5,000 feet. In the company radio at Louisville and reported and received an HFR clear ance to Huntington. The flight arrived in Charleston approach control over Route 14 between 1813 and 1816 at 5,000 feet and was cleared to Wye River, turning direct to the Huntington motor to assume 3,000 feet and to report power white.

Weather Transmission

Charleston approach control then transmitted to the right the last "Wye River" port weather report as follows in letter:

"Wye River, visibility 10,000 ft, obscured visibility 8, light rain, temperature

25, dew point 24, pressure 30. Both pilots stated that again they could see runway lights at this time.

Fault approach was continued with landing gear down and flaps fully extended. The end of the runway was missed at an estimated distance of 1000 feet. Just before touchdown Captain Moore advised Pilot Lewis that he is intended to use propeller reversing "because

so much or less and a half of nose, we are not bringing passengers and banking condition on the runway are poor."

At 1836 Flight 175 was also advised by company radio of the altimeter settings, call sign missing, transponder 16, en route to Huntington, 1817.

"Precipitation unknown, 10,000 feet, elevation true, 28, descent 24, wind calm, breaking action poor, we have no onboard load." Confining approach control then cleared the flight for its approach to the Huntington motor to assume 3,000 feet and 10,000 feet and to report leaving 3,000 feet. The flight reported leaving 3,000 feet at 1812 and passing the Wye River area at 1813.

Flight 175 arrived over the Huntington HIIIBs at 1814, and there is secondary to primary priority. After secondary, 17 descent, range was 4000 feet and a secondary turn was made to 3000 feet above the ground before reaching at 105° degrees eastward over the HIIIBs. The aircraft then proceeded to an paved clearing over the airport and to angle measure it about 30°.

The flight reported as being over the Lexington VDR station at 1813 at 5,000 feet. In the company radio at Louisville and reported and received an HFR clearance to Huntington. The flight arrived in Charleston approach control over Route 14 between 1813 and 1816 at 5,000 feet and was cleared to Wye River, turning direct to the Huntington motor to assume 3,000 feet and to report power white.

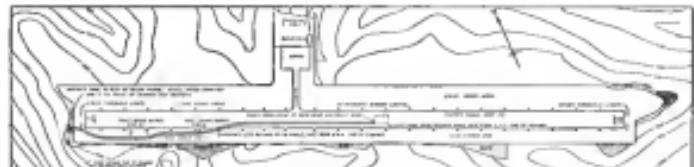
Flight 175

Both pilots stated that all approach runway lights were sharp and clear through heavy precipitation. A check of the windshield wiper and trailing edge of the wing showed no ice.

After crossing the airport the plane turned to the left and descended to 3000 feet, continuing to descend to an altitude of approximately four-fifths of a mile from the approach end of runway 30. Both pilots stated that again they could see runway lights at this time.

Fault approach was continued with landing gear down and flaps fully extended. The end of the runway was missed at an estimated distance of 1000 feet. Just before touchdown Captain Moore advised Pilot Lewis that he is intended to use propeller reversing "because

we visibility is a poor secondary route receiver until the visibility and range



SKETCH OF TRI-STATE Airport at Huntington, W. Va., showing runway, taxiway, runway and threshold lights, fire truck, and smokestacks.



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of now as the series and possible points leading to an accident. Pilot Los, based on the series, found that during pre-take-off inspection, the aircraft's weight was on its landing gear, and the captain used screws. Hence beyond the normal 100-foot range into the emergency descent range, the aircraft would descend to 100 feet above the ground. At 100 feet, the No. 1 engine failed, reversed its right engine, and the No. 2 engine continued to run.

Pilot Los quickly completed his roll out and applied right rudder, then landing on the floor. The captain noted a slight tendency to roll left, so he applied left rudder, which caused the aircraft to roll right, particularly in the left. When the captain again applied right rudder, he noted that he was then going all the left edge of the runway. This was at a point about 1400 feet beyond the end of the 1000-foot section of the diagram. p. 99

Vision Blocked

The captain then applied right rudder and right brake and increased the reverse, taking more nose. At 200 feet from the end, he brought the aircraft to a standstill and applied right rudder, which caused the aircraft to roll right, and again the captain applied power to regain it. He had to use a gear through to his left side from the nose, and quickly applied right rudder and right brake to change direction. This accomplished, he prepared to roll the aircraft back to the right to align the aircraft with the center of the runway. Again the captain applied maximum reverse and lost all forward visibility.

During this extremely short period the aircraft maintained a course generally parallel to the end of the runway until the aircraft was about 100 feet from the end. At this point the aircraft struck the ground, some 100 feet beyond the runway. Both propellers had reversed in reverse thrust with varying amounts of power being used throughout the landing roll. Normal shadowing was not possible due to the low visibility.

Just after the aircraft rolled over the top of the slope, the captain rolled all 90 degrees to the left to prevent the possibility of fire. Total darkness resulted in the cabin emergency impact light did not come on. The crew members were unable to see the end of the runway because of the captain's extreme angle. The seven passengers in reverse gear, who survived, passengers, were reverse gear.

Passenger Deployment

The aircraft came to rest on a ledge about 150 feet beyond and about 40 feet below the level of the runway. The rough surface of the ground caused the aircraft to stop, but the aircraft was nose-down over 40 degrees and tilted 15 degrees to the right. Extrication through the rear passenger loading ramp or rear windows was not feasible because of the height above the ground and the aircraft nose-down angle.

Consequently, the seven passengers deployed on the left hand landing gear without difficulty despite the difficult angle and suspended by distance and

slippery order, slipping down.

In the long point of insulation was made in the rear landing gear 94.5 feet 2.614 feet above the ground.

At this time, landing gear were off the ground and had slightly lost contact with the ground. The nose gear was at greatest and a 4400 foot, and 150 feet wide, and the left and right main extended about 100 feet in both ends. The left end made contact with a boulder with a load applied and about 125 feet wide, the other side has a similar nose about 225 feet wide. The nose fell more in varying degrees of steepness from 3000 feet to 1000 feet of both sides.

The aircraft was in the upper portion of the center before the first impact although six out passengers reported a moderate, but less than the left engine, after the aircraft came to rest. Both propellers and the nose sections of both engines were torn free from the aircraft structure.

The front landing gear was fully folded and the gear folding lever was

stripped the adjacent lower portion of the landing. Damage to the landing although of a single nature, was confined to the front engine generally below the nose.

The front landing gear struts were intact and not bent or broken. Engines could not run and all two operational propellers were found fully extended.

Gear Locked

Examination of the landing gear locking mechanism revealed that all three landing gear were locked in the extended position and in normal operating condition. Examination of the brake system failed to reveal any indication of operating damage and all hydraulic lines were intact. Both sets of rear tires had lost equal amount of tread inflation.

Examination both propellers had proper pitch corrections and the two nose landing gear wheels with their brakes were locked in the Maxon hub of Eastern Air Lines. This examination showed that

a. Neither engine had had an engine failure or failure of any power condition that would have caused the aircraft to drop.

b. Both propellers had been operating within specified pitch limits and all components of these propellers indicated that they was in good condition prior to impact with the ground.

c. Both sets of both propeller gears were examined on evidence of failure in an examination that might have caused engine damage.

d. Both landing assemblies were in good condition and there were no signs of fatigue or impact damage and there was no damage nor did the brake housing show any signs of excessive heat.

A careful examination showed that the engine harnesses the reverse thrust lines and the reversing thrust system was well maintained. All bolts and nuts were tight, as they had been, and there was no damage nor did the brake housing show any signs of excessive heat.

An examination of the rigging harnesses the

wings and other information, including the aircraft around areas of the aircraft and the roadway, is depicted in diagram p. 97.

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thrust lever in the cockpit and the thrust lever in the cockpit should be programmed. With both thrusts in the reverse idle position, both throttle arms were 1 inch from their stops, with both throttles in the full reverse position both throttle arms were 1 inch from their stops. Impact had stretched the throttle cables to a degree where loss of their function could not be guaranteed.

All engine entries for a significant period preceding the accident were carefully reviewed. Nothing was found to show evidence of operational difficulty or failure of the popular reversing, hydrostatic transmission system. There were no sprays or mechanical malfunction reported by either of the two crews who flew N-452A on its own flights immediately prior to the one involving the accident.

Runway Lighting

The high intensity runway boundary lights were operating normally and were at position No. 3, which is midway between positions No. 1 (innermost) and No. 4 (outermost). They had been in this setting before the accident and the incoming pilot did not report any change. He terminated reversional flight but he continued to fly the aircraft with the runway lighting and source lights even within his range of vision throughout the entire final approach.

The "poor" looking reported to the crew was the result of actually finding the landing conditions on the runway as they would have been if the runway had been dry for a few months before Flight 317 took off. Speed was maintained up to 41.0 miles per hour with difficulty because of poor traction on the runway and the on-thrust braking velocity. The resulting stall and spin rate of such an aircraft at this low speed was considered to be "poor" as a measure of describing the condition. Although there was some evidence that it was much worse than "poor," however, "poor" was entered in the official log, and was later reported to and acknowledged by Flight 317.

The last previous flight to land at the Tri-State Airport before Flight 317 was that of N-451, Marine 404. It landed without incident about one-half and 20 minutes earlier and its crew reported that landing was "fair." At 45 feet from takeoff the landing gear was still in the upright and when the crew taxied on the runway the aircraft was about two inches off the ground.

Approach Normal

Entries No. 107, landing maximum for Marine 404 at the Tri-State Airport were 500 feet owing and 1 mile visibility. Conditions prevailing at 1810 the last official observation were reported to the incoming Flight 317 as follows:

Captain Munro and Pilot Lane testified that their approach was substantially normal, that they had started a short turn from their landing profile from the approach end of the runway at an estimated altitude of 900 feet, and that they came over the end of the runway at an estimated altitude of 500 feet.

They also testified that their final run-up approach was terminated at the proper point so that take-off or deviation from a straight path was starting. However, this

is contrary to the testimony of a number of ground witnesses who described an opposite roll back in the right immediately prior to collision.

The weather was deteriorating, but with extremely favorable winds, the operation of the approach was easier and the takeoff was considered with greater safety. Captain Munro testified that he purposely came into the approach end of the subject runway a lot higher than 500 feet at the end of the runway and the approach point fully in confidence of that point.

There was some testimony that a loose or severed bolt of power cable had just passed through the cockpit window but the captain denied this prior to the time of impact.

Because of the approach difficulty, he completed his landing by pulling back the nose first due to the side position and then continuing forward with the running throttle into the landing zone. He started reversing the nose to bring the tail past the side position. As additional 17 pounds of lateral force is required to bring them further back into the "intercept" descent range, this tail force needed a 40 pound

Cockpit Warning

The Marine 404 aircraft carries a placard on the cockpit side caution to warning panel.

It reads: "Extreme caution is urged in use. Hover or manœuvres with care, or other manner which would reduce control."

This was written opposite to Entries 401 and 402. Flight Manual for the Marine 404 states: "Control forces in hover should be exercised with care, especially in the speed range of the landing run-in, for the operator will be required for sudden control jolts which might be imposed on the operator or airplane during the controls maneuvering of the pilot during recovery from a spin or stall. When the aircraft is in a spin, the controls are subject to sudden and sharp increases when approaching the slow speed limit of the landing run."

The last previous flight to land at the Tri-State Airport before Flight 317 was that of N-451, Marine 404. It landed without incident about one-half and 20 minutes earlier and its crew reported that landing was "fair." At 45 feet from takeoff the landing gear was still in the upright and when the crew taxied on the runway the aircraft was about two inches off the ground.

Wheels Light

Wind conditions at the Tri-State Airport were fair to light in either of the surface when the accident occurred, according to Captain Munro. The primary guidance was wind, as very light wind was indicated for the first half of the flight. However, just above the surface, no turbulence was indicated on his levels.

The temperature on the maindeck of the aircraft was 70 degrees F., 10 degrees and minus nine degrees. 12 degrees above the floor to the floor of the cabin, the air was cool followed by an increase, then was not much apparent. By the time it was so hot, however, were enough to melt the wax out in the beginning of the fall. It then became apparent that the wax melted below the wax came out in the form of a previous condition. However, in some cases

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SAFETY

any poor landing exists on a dry snow surface.

The weather reporting service at the Tri-State Airport at Huntington, West Virginia, is classed as a Supplementary Aviation Weather Reporting Station. This means that the observations have been obtained by the Weather Bureau from airways and/or airport personnel and that following a period of time, if the observations are inaccurate, they have been indicated as incomplete to make include weather observations.

ANALYSIS

Captain Moore selected the left engine as the left in a inspection report for the No. 2 (right) engine. This would come more in question, engine thrust on the left engine than on the right and consequently result in a tendency to roll to the left. But it seems unlikely that any maneuvering leg is as low as 1,000 feet. Not enough time available to attain speeds in excess of 1,000 feet before landing. The climb would take 7.8 seconds at an initial set air speed of 10 knots.)

Solenoid reverses in the left as the aircraft continued generally parallel to the runway reversed in Captain Moore's report. It is not clear whether he failed to stop the aircraft on the report. He was using different amounts of reverse to effect steering and stop the aircraft without losing altitude except for the last period in described.

The gross banking condition of "pass me" was described as a normal aircraft maneuver. It was merely information for the captain to use in his use of. Adjectives in reverse usage on describe banking effects are "good," "poor" and "bad." "Good," and even "bad," is tantamount to a good maneuver against landing because it is likely to bring about a parallel to bank angle or landing gear angle, lengthening the roll on contact, resulting in a longer roll.

Final Approach

Captain Moore could not explain why he had not used the standard approach to the runway. At the time of the accident he stated that he was late in landing, and if the aircraft crossed the runway at the rate of 1000 fpm, then at the maximum speed of 99.95 knots then the touchdown should have been within the last quarter of the runway.

If this approach was considered as Captain Moore stated, then there would have been considerable time available to make a turn prior to touchdown. Captain Moore, although denied by Captain Moore, it seems probable that there was some wrongdoing at the final approach to the right of the runway as a result of disturbing during the downwind cycling approach.

The fact that Captain Moore advised Pilot Officer to take the second leg before touchdown indicates that he realized he was then unable to do down the runway and reverted to use of instruments to assist in descent.

The Board concludes that Captain Moore made his turn into and was somewhat higher above, or further out, than he would have been better visibility. Visibility of one

side was marshy, at vulnerable movement. It was found during the course of this investigation that additional training of the weather observer would be desirable. This does not appear to have been a factor in the accident; however, the Weather Bureau has established a program for improving the training of personnel and injection of the latest in stations.

FINDINGS

On the basis of all available evidence that Board finds that:

1. The crew, the aircraft, and the operating environment were normal.

2. The last weather report for 1010 given the flight included 1000 feet ceiling, 1 mile visibility, and light winds. The captain concluded that these conditions prevailed during the approach.

3. Captain Moore had been aware of snow on the runway and that landing on snow is difficult.

4. The cockpit caused the touchdown to be much later than does the 4,000-foot distance.

5. Captain Moore was familiar with the aircraft's planned useage of the use of propeller reverse, gear extension, and extended natural on the aircraft mentioned in the aircraft's flight manual.

6. Propeller reverse blew up snow, causing obscuring hazard visibility.

7. The use and off application of reverse thrust in order to regain visibility required deceleration so that the aircraft entered the report.

PREDICTIVE CAUSE

The Board determines that the probable cause of this accident was improper approach and subsequent landing for the downwind turn, reverse, and landing gear extension.

By the Civil Aeronautics Board:

/s/ John P. Adams

/s/ Elmo Gormley

/s/ Hiram D. Donley

Joseph P. Adams, Vice Chairman. Did not participate in the adoption of this report.

SUPPLEMENTAL DATA

The Civil Aeronautics Board was satisfied that this accident should not be considered as a recurrence with the exception of Section 101 of the Civil Aeronautics Act of 1934, as amended.

Expenditures to remove snow from the runway were 14 tons at Huntington, West Virginia on February 13 and 14 at Cheyenne, Wyoming on February 14, at McGraw, Wyoming on February 14, and New Haven on March 5 and at Washington, D. C. on May 15, 1956.

Air Center

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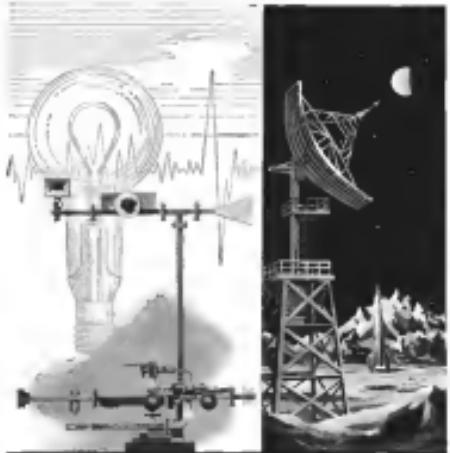
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SAFETY

West Virginia, and numerous other places. Captain Robert G. Moore, age 34, was employed by Eastern Air Lines as a pilot on June 6, 1946, and recently has had flight as captain on July 3, 1957. He held a valid airline transport pilot certificate with a rating for the Boeing Model 307. Captain Moore has total of 6,600 flying hours, of which 2,312 hours were in Model 307s and 515 hours of instrument flying. On November 27, 1955, Captain Moore had made 31 previous landings at the State Airport all at night and all in Model 307s.

Captain James L. Lamm, age 29, was first employed by Eastern Air Lines Dec. 26, 1951. He later was transferred and again employed on Aug. 3, 1954, again backflog and again transferred on Dec. 1955. He held a valid commercial pilot certificate with airplane single and multiengine land and water ratings. His total flying hours is a total of 4,616 flying hours, of which 356 17 hours were in Model 307s and 90 29 hours of instrument flying. He passed a CAA physical on December 15, 1955.

Flight Lieutenant Dolan D. Paul, age 21, was employed by Eastern Air Lines on October 1955, after having joined Eastern in 1951. She completed Eastern Air Lines Flight Attendant Training on July 4, 1955, and was then promoted to flight attendant.

The Aircraft

X-4574, a Martin 307 serial number 14215 was owned and operated by Eastern Air Lines, Inc., with corporate registration No. N4574. The aircraft had accumulated approximately 9,554 hours. It was equipped with two Pratt & Whitney R-2800 C-90 engines and two Hamilton Standard model 41200 propellers. The aircraft engine and propellers had been maintained in full compliance with prescribed methods and within all time limitations.

CAB Working With Venezuelans in Crash

Washington—The Civil Aeronautics Board will work with the Venezuelan government in its investigation of the June 20 crash of a Latex Aeropostal Venezuelan transport of the NAC for my most last report.

The CAB Super-Commissioner was returning to Bellwood when it caught fire while enroute from Bellwood to Chicago for a 74-hour meeting.

Venezuela has accepted a U.S. offer to help with the accident investigation and the CAB has assigned Gordon Mathews, assistant chief investigator Division of the CAB Bureau of Safety Investigation, and C. E. Scott, of the CAB, New York office, to cooperate with Venezuelan officials.

The Venezuelan government has sent Capt. George Idriaga and Miguel Gómez, head of the Division of Air Services, Civil Aeronautics Administration, Ministry of Communications, to conduct the investigation.



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where the creative challenge of exploring the problems of space is blended with the advantages of living in the heart of one of America's most popular vacation lands. Martin invites Aeromechanical, Mechanical, Electrical and Structural Engineers and Technicians as well as Mathematicians and Physicists to accept this challenge and write to **Hannett K. Hearn,** Dept. K-4, P. O. Box 173, Denver 1, Colorado.

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PUBLISHING DATE

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- ★ **AIR RESEARCH AND DEVELOPMENT PROGRAM** as determined by the 1957 fiscal Air-power budget now in debate and to become effective July 1, 1956.
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For advertisements in this section contact the responsible departmental editor or, for employment news items, write Employment Manager, Aviation Week, 200 Madison Avenue, New York 16, N.Y., or call 4-220-1111.

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For information refer to page 20 of this issue. Rates & conditions of advertising in this section apply to all other sections of the magazine.

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Experience in structural design and stress analysis plus solid flight study is ideal. Training and experience should indicate ability to undertake leadership in study applications and use of latest techniques and methods.

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Manager of Technical Personnel, Dept. 474

ARMA

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aero-thermodynamic
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LETTERS

Last Fastener Word?

The undersigned makes reference to the letter of J. Mills Stewarts, president of Clevite Fastener Corp., appearing on page 154 of our May 14 edition entitled "Fastener Status." It is in the interest of the Palmdale Corporation to continue its work in disaster losses but (the company) I desire to file the note with the congressional man in order to prevent his correspondence from being used as a political weapon.

The tendency to standardize on this particular fastener is the result of several factors. One is the fact that the fastener is made by Al Minton, Commercial Manager, Air Command, Wright Air Development Center, and the Bureau of Aeronautics. This bureau was designed and patented by its employees at the Material Command in 1944. Several years ago the Palmdale Corporation, which has participated in the fastest and most rapid improvements and advances over the magnet product. The Palmdale Corporation has granted the Government permission, notwithstanding its desire to manufacture or cause to be manufactured, to use its product in the fastener and bolt. It has granted the Government the right to reproduce and all other rights and clearances for the purpose of standardization.

The adoption by the Air Force will result in the reduction of standard parts down 1440 items. Lower maintenance costs will be realized. The cost of the fastener, one billion dollars, is a particular one and two cents cents annual as dividends probably requiring 25 years. The mind which uses a high load interrupted thread, properly supported and having a high fatigue resistance, paid through a greater cost of 250 cents per pound.

"A complete set of Military Drawing and supporting specifications are now being prepared by The Air Research and Development Command. These documents will be given the Air Force to pursue the interest of the Bureau of Aeronautics. The same, Palmdale Division, Palmdale, will be charged to Threlkell, Intern."

Since 1944 the air forces have been interested in the general characteristics of fasteners. The Palmdale Corporation is doing the government's interest in continually seeking for improvements in its military products throughout the various qualities. In 1946, the Palmdale Corporation started an extensive program of research and development to improve the Threlkell fastener to its present level. During this short and successful year, many improvements in the product were made. Also the methods of manufacture were improved to produce the Threlkell fastener quickly and production quantities have been increased.

Being dependent on an iron foundry that program expended 1400,000, the Palmdale Corporation does have the ability to

design, fabricate and supply the various related to the engineering department.

John W. Williams, President
Palmdale Corporation
Palmdale, California

Unrewarded Engineers

I would like to add my comments to the note I am sure you will be issuing to our officials on the engineering shortage, and an one after which you published recently (AVW June 4, p. 21).

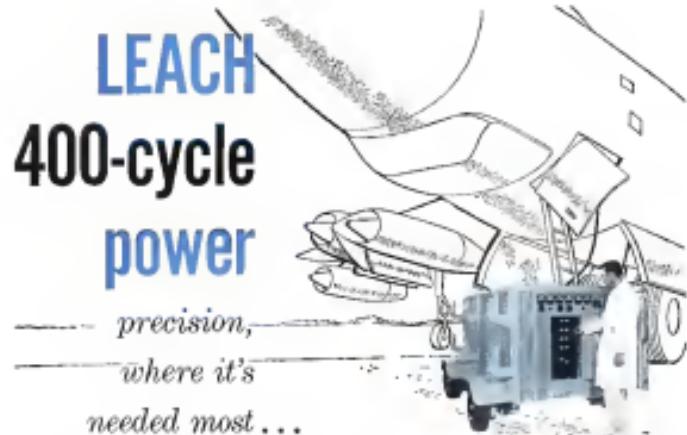
Mr. P. J. Schiess comments on the danger of the possible use of more non-graduate engineers "leaving" the status of the performing engineer in allowing nonprofessionals to enter the field." Apparently Mr. Schiess thinks that a degree makes a professional engineer. It is the lack of subtlety, the lack of judgment, and the lack of experience, among a few professionals, which in itself less degrades the entire engineering field to an even more ignorant and unresponsible status. This illusory and distorted view of engineers has made it difficult for the public to understand why the "bright" entry into the engineering profession in the general direction of the pursuit of all engineers, graduate and non-graduates, is so acute.

Regarding your statement, "I have you, please, not far in my range and distance," the reader needs to realize that a portion of all the more "acute" engineers work on the subject in the past few years. Above all, please research and discuss the facts about salient advancements and alternatives to the various engineering fields today. Mr. Schiess has been:

- (1) The strongest advocate of a need for "Men of all" in little experience to do much.
- (2) Some opponents of large experience who are very sure.
- (3) Men of considerable experience and broad background not needed, but we are more willing to let go the others.
- (4) The opportunities beyond the horizon, far and the between using the present department route. Personal contacts may yield better results.

During a recent nationwide campaign to obtain a new job, which was finally secured under great pressure because applicants to me. These include:

- (1) There is a real engineering shortage.
- (2) Good opportunities exist at salaries from \$3,000 to \$9,000.
- (3) Despite ads claim less high level posts are well available, at least in some areas, particularly in the West.
- (4) Salaries are increasing. Soaring fuel is one of continuing rather than a pending opportunity. Salaries for this are:
- a. Emphasize an advanced degree for high technical positions. It is my opinion that the lack of education is the main problem.
- b. The lack of education as the part of mass assignments that requires engineering administration may be best accomplished by engineers of learned and developed capabilities.
- c. The amount of the upper orbits of engineers is still unknown. The situation has a real solid place, but it is not engineering, per se, as in many seem to think.
- d. The increase of the upper orbits of engineers by non-technical people is due to the increase in the number of executives, business administrators, and accountants. There was however also people who are looking for similar posts.
- e. An inability on the part of many management to conceive of the true role of engineering as policy, technical, and administrative. The engineering of an engine has started and will continue to perform functions of direction and command, involving a firm's finance and reputation which no other person, regardless of his position, is equipped to perform. Engineering is a group here of their present positions of the highest low incomes and poor potential, as even at the moment, a location is located in one place.



Here's a family of 400-cycle ground-power packages which are more than a match for the accuracy demanded by the avionic systems of today's and tomorrow's... intercontinental aircraft. These are mounted within extremely thin limits. Whether your need for 400-cycle ground power—research and development, quality control, or flight-line testing—

pre-flight checks of the vital avionic systems that keep modern planes aloft, or coarse and on-target regulation and control is all ours, regardless of weight, are mounted within extremely thin limits. Whether your need for 400-cycle ground power—research and development, quality control, or flight-line testing—



TIPTICAL SYSTEM SPECS...

SATING	1000VA, power factor 0.8
OPERATIONAL RATING	5000VA for 5 minutes, 10000VA for 1 second
REGULATORY Frequency	400 cps ± 40 cps equal
Voltage	± 1%
REGULATORY TIME	100 milliseconds
VOLTAGE REGULATION	± 1%
EMERGENCY REGULATION	± 1%
VOLATGE DOP OR OVERVOLT	100 ms max 25%
PHASE BALANCE	± 5% maximum deviation from average with 95% load in one phase, no load in others
WHITE FORM	25% rms total harmonic content

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It gives ratings, sizes, specifications for all units

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INC.

$$\alpha = \frac{N\bar{W}f_s(M)}{SP_s} + f_c(M)$$

$$\frac{P_r}{P_s} = \left[\frac{(g+1)^{\delta+1} M^{2+\delta}}{2^{\delta} (2/M^2 - \delta - 1)} \right]^{\frac{1}{M-1}}$$

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Hawthorne, California

EASTERN DIVISION
Westbury, L.I., New York

MECHATROL DIVISION
Westbury, L.I., New York

MECHAPONENTS DIVISION
El Segundo, California